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STATE RESPONSIBILITY IN UNIVERSITY EDUCATION *

IT is not without trepidation that a son of alma mater appears before you to-day to speak upon a subject whose complicated relations will be apparent to the most casual observer. Even the evidence of maternal interest expressed by the invitation to return to the bosom of the family for a brief visit fails to give assurance in the face of a memory calculated to inspire awe rather than loving remembrance because in the eighties the "propitious mother" restricted her family responsibilities to a periodical and very formal enquiry into the limitations of the student's knowledge. Each of us was left to acquire his sustenance at the breast of a foster mother—the college—for whom love was developed by individual memories not to be expected from the impersonal relations borne to an unnatural, but none the less real and disciplinary, parent. Our university bore us her children, but did not mother or rear us.

Familiarity with the early history of the province and university, a practical knowledge of the workings of the English and German universities and a somewhat lengthy experience in different capacities in an American state university, whilst affording a basis for comparison of view points, methods and educational results, may not, it is true, qualify one to draw deductions as to the responsibilities of the state in university education. The citizens of all

* The second annual opening address delivered by invitation of the faculty of science of the University of Manitoba, at Winnipeg, October 25, 1907.

free countries are, however, encouraged to believe that each has a right to an opinion and to give voice to his opinion.

Manitoba is unique, not in her provincial or state university, but in the fact that she has limited the power of conferring degrees to that university, and it is eminently fitting when a state decides to establish an educational mechanism that she should control the situation. This assumes what should be the case, that the state is stronger and better able to do what she undertakes than private individuals or corporations and the chief advantage lies in the avoidance of duplication of effort and expense and in the possibility of maintaining a universal high standard throughout the confines of the state.

The education of succeeding generations of students is a matter of great and vital public interest and therefore one with which the state may deal directly if it sees fit. That Manitoba was far-sighted when nearly thirty years ago she decided to place the responsibility and control of education in the hands of the state, is a matter of gratification to us all. That she is still striving for the highest ideals and greatest practical efficiency is indicated by the recent appointment of a royal commission to investigate and make recommendations on university affairs. She naturally wishes to see the limits of her educational responsibilities in order to approach the problem in a business-like way but if her university is to be what the name university implies, namely, a center for the *dissemination* of all phases of human knowledge, it must be first of all a center for the *accumulation* of all phases of human knowledge. It is therefore apparent that limitations can not be set nor the future of education be forecast, since it goes hand in hand with or rather should precede and inspire social and economic progress. Indications should be available, however, in ample time to anticipate development along important lines.

Manitoba should and doubtless will avoid the pitfall of young universities which are suddenly confronted with the necessity of having available the most accurate and exhaustive information on every conceivable matter of human interest. Many universities content themselves by meeting their responsibilities on paper and publish multitudinous, awe-inspiring, polysyllabic courses of instruction all out of proportion to the number and qualifications of their staffs. Such dangers may be met by provision for the groundwork of the humanities and the basic sciences with later departmental specialization first along lines which present the most pressing practical and local necessities, or where conditions furnish local opportunities especially valuable to any one branch of knowledge.

A university presupposes, however, that there shall be a continual intake of knowledge on the part of those who are to give it out. This can best be done by a combination of two methods, both of which should be utilized to the fullest extent. The first is stimulation to research and the second is opportunity to know practically and at first hand what has been done and is in the process of completion by other workers along similar or even widely divergent lines.

Research is only possible where ample facilities and time are available in a sympathetic environment. In these days of gauging results in financial terms, the value of research is apt to be overlooked unless it has an immediately practical application. Imagination is often sadly lacking in the so-called *practical* man who is so likely to be limited in his field of vision if not shortsighted. Ideal results are to be obtained by the cooperation of the man who thinks with the man who works.

Many people use the word research so

frequently and with such a superior air that it has become hackneyed and the use of the word is apt to provoke a smile. The value, however, of studies or researches in the solution of purely local and commercially assessible problems pertaining to engineering, agriculture, mining, fisheries and matters of public health and animal industry appeals to all. It is when we approach abstruse questions dealing with physics, chemistry, astronomy and the biological and other sciences, that we have difficulty in interesting the general public and demonstrating to localities the need of provision for research. We need not remind ourselves to-day of the contributions of astronomy to practical navigation; of chemistry to commerce, where in many lines, particularly in Germany and even in America, trained chemists, graduates of universities and technical schools are employed; of the recent developments in relation to X-rays; of practical knowledge concerning the causation of disease, resulting from the study of bacteria and the animal parasites; of increased fertility of soil; of cross-breeding in plants and animals; and of other commercial benefits directly traceable to university researches in these sciences, because even if there seems to be no immediate or remote possibility of practical application to human affairs, the mere stimulus of an atmosphere of investigation in a teaching institution is inestimable. No teacher can inspire students like an investigator and recognized authority whose life is spent in building stones into the foundation wall of the subject which he professes, and students who have daily opportunities to see new facts brought to light, new methods employed and new conclusions reached are able to secure a vital and definite grasp of important knowledge and find their mental faculties quickened in a way quite impossible to the human sponge who soaks himself full of information, the original source of which is quite unknown and indifferent to him, but which he learns from a book or lecture. We remember and utilize in after life what we get from actual personal experience or see demonstrated in a practical way, not that which we are dogmatically told by parents, teachers or writers. As has already been said, the professors and staff of a university can not be continually giving out information unless they are continually taking it in. The teaching will be efficient and the reputation of the institution great in proportion to the opportunities which are afforded the instructing staff to advance its own knowledge, of which the most important is individual research.

The second stimulus necessary to the continued growth of the university staff is opportunity to know what is already known. This is not alone to be found in books. Much can be ascertained from books and the current journals, and the absolute necessity of ample provision for a library should need no exploitation, although many universities which do not seem to spare expense in building and equipment are apt to be niggardly in supplying these tools which are essential alike to staff and student. Both teacher and pupil should always refer to the original. It is not enough to know a thing when one may know who said or did it and the conditions under which it was given to the world. A personal acquaintance with the workers of the past can only be secured through their writings and the views which others have had of them. Of present-day workers a knowledge may be had by reading their books, monographs and journal articles but a far more real idea of their methods and view points and of the actual results obtained by them may be secured by personal contact at association meetings, by visiting them in their own environments and working with them in their laboratories. Uni-

versities should provide opportunities for members of their own staffs to visit other universities and for other teachers and workers to avail themselves of their own local advantages. This is not luxury; it is essential to progress and is demanded, recognized and met by commercial, social and political interests in their own lines of work.

A university professor should not be a compendium of useless information, but the recognized authority in his locality upon the subject professed. He should have ample expert and other assistance.

If the department is railway engineering, the staff should know more about it than any railway interests in the land, so as to be able to advise the state, or, when called upon, the railways. The chemical department should know more than any chemist engaged in commercial pursuits and should be encouraged to develop methods and processes which will be of economic utility to the state. The geologist and botanist should be of great assistance in the practical working out of state interests, particularly in the newer communities. The economists should not be theorists alone, but should be used to the utmost in solving economic questions relating to taxation, banking and business in general. The medical department in each of its specialties should be represented by men preeminently fitted and trained and practical in their temperaments. Law departments should be manned by staffs which have the respect of the bench, bar and general public.

It is apparent that the professor of today must be keen, alert and thoroughly trained and can only be brought and kept up to date by the most strenuous exertion on his own part and liberal opportunity on the part of the university with which he is connected. He must know his own locality thoroughly in order to know how other methods employed in other countries may be applied with advantage to the local problems. He must know facts in books and out of them. He must be able to draw correct conclusions. He must teach and he must have books, and other tools, facilities and assistance. If he is to be an authority on what he professes he must specialize, and to-day we do not have and cannot expect to have a professor of more than one branch of knowledge, although it is not long since a *so-called* college of the far west advertised in its calendar a "professor of Greek and dancing."

Conditions which govern humanity may be improved in thousands of different ways, and it should be the aim of the state, through its university, to improve the condition of its citizens in every way. The university should lead, not follow. The state should afford a moderate degree of education to every one of its citizens through funds derived from the pockets of all. Whether university training should be given gratuitously to all citizens of the state who have made themselves eligible by a previous course of study is very questionable since in the absence of proper initiative, good judgment and ability to work hard, individuals may be educated out of their sphere, that is, given a knowledge of more facts and methods than they find themselves mentally able to digest and assimilate or to utilize in the ordinary every-day practical affairs of life.

All educational, which *must* mean research, institutions will probably be run at a loss so far as returns in immediate applicability to the problems of life are concerned. It is therefore necessary for the state or some other force to endow such institutions adequately so as to meet the deficit which results from insufficient payment by those who are taking advantage of opportunities afforded, but whose later labors may return to the state many times over the initial cost. It is very question-

able indeed whether the citizens of a state should be pauperized by being educated without cost, unless we go to the extreme of communism and leave the state to select early in life the line of activity in which it is to utilize the individual and prepare him for his life work without cost, demanding in return the exercise of the abilities which have been fostered in him by the state. This is a development in socialism to which we shall probably not attain for many generations. In the meantime a middle course may be selected whereby the individual will be required to make personal sacrifice and expend his own resources in fitting himself for the walk of life selected by him, but for which adequate training will be provided at a financial loss by the university and, according to the basis of our consideration to-day, the state university. In this way, care will be exercised by the individual in the choice of his vocation, appreciation of student opportunities will result, the risk of pauperizing citizens and educating them out of their sphere will be avoided and the educational deficit will be met. This certainly is a good business venture for a state.

Every community is accustomed to grant bonuses to infant industries for the encouragement of commercial interests and to enable them to equip themselves thoroughly and introduce new lines of activity. Most countries levy customs dues on certain manufactured products and even on raw materials so as to develop home production. It is therefore no new point of view to expect a state to provide adequate bonus for a manufacturing plant intended to train succeeding generations of its citizens in a way which will render them capable of taking their places in the world at large and at the same time to develop local resources so as to make their community as commercially independent as possible. This is being done in certain instances. In Minnesota, the experiments by the university upon wheat-raising, whereby it is now possible to make two or even more stalks of wheat grow where only one grew before, need no comment, and its work on animal husbandry is international in importance. The state of Wisconsin, first by university research and secondly by teaching the principles thus worked out, to its large farming class, has succeeded in producing even a greater revenue through its dairy products than is derived from wheat in its neighboring state, Minnesota. Germany affords perhaps the best example of support of educational institutions by the state, although there is a great difference in the method of working out the problem, as compared with American institutions. The work of von Hoffman on coal-tar products at first seemed to be of mere academic or educational interest, but there are now so many practical applications in dyeing, flavoring extracts, drugs and other synthetic compounds, that we scarcely realize what we owe to a university professor. The work of von Behring and of Koch, backed by governmental university support, has given us antitoxin, on the one hand, and thorough knowledge of tuberculosis, cholera, typhoid fever, anthrax and many other diseases, on the other. Is it not fair to assume that the scientific and technical education fostered by the state in the schools of Germany is responsible largely for her ability to manufacture raw materials into finished products so cheaply as to compete with all nations, even on their home grounds, and in the mere matter of mines to take material which has been thrown away as worthless in the more "rough-and-ready" American methods and from it make a second vast fortune? In comparing Europe with America we have to class ourselves as extremely wasteful, which was not of so much import, except as it affected habit, whilst the country was

sparsely populated and the soil still virgin, but it becomes of growing importance with the advent and birth of new citizens and the exhaustion of the soil by repeated crop demands. We all return to mother earth for sustenance and from her bosom we derive life itself.

Each community does wisely if at the very outset it takes stock of its local assets, studies environmental and other conditions which affect operation, and takes immediate steps to utilize its local advantages to the utmost whilst exercising due care for future generations. It is strictly within the function of a university to aid in a practical way. Had the state been developed to its proper point, Edison should have been working in a university and not for his own and others' personal gain; Luther Burbank would have been stimulating colleagues and students by his observations; some national or state university would have sent Walter Reed and Carroll to Cuba instead of leaving it to the United States Army to solve the cause of and methods of protection in yellow fever; Marconi should have been developed in his practical applications as he had been in his theoretical knowledge by a university. In this way the state, that is all the citizens, and not individuals or corporations, would derive more directly the benefits which accrue from advancement in knowledge.

Manitoba can not content herself with teaching the languages, philosophy, mathematics and the sciences as known. She *must* be engaged in finding out new facts, not only those directly applicable to Manitoba, but those which are of world-wide importance. She must make provision in money, time and opportunity for the members of her university staff to engage in research. Fortunately, she has already secured in her university men who find some time for research and publication of results, but at a personal sacrifice of which the general public knows little or nothing.

This province has a fleeting present, practically no past, but a glorious future. If that future is to be well planned, provision must be made for a thorough study of local resources and the training of citizens properly to conserve and develop those resources. This can not alone be done by study of books or of methods used and results obtained elsewhere, but by practical and prolonged study at home of the local situation; in other words, research must be liberally provided for. This Manitoba will doubtless undertake, one line at a time, thoroughly equipping and fostering each, thus gradually covering the whole field of human activity. Her university should be used in its various departments as the source of expert advice and ultimate court of appeal in all matters pertaining to present knowledge and future progress, not as involving alone a question of Greek roots, history or philosophy, but in such concrete considerations as transportation, mines, public health, agriculture, industrial chemistry, formulation of methods of banking, drafting of new laws and other such practical lines of development, all of which are primarily of public interest, although frequently wrongfully used for purely individual ends.

The scope of the inquiries which the royal commission is expected to make is broad and perhaps it will not be thought impertinent or without the bounds of good taste if an alumnus of this institution, who has followed its development from the beginning until now, should say a few words concerning certain of the provisions given in the appointment of the commission.

THE SYSTEM OF UNIVERSITY GOVERNMENT

The instructions given to the commissioners would warrant the assumption that the present method of university govern-

ment is cumbersome and not wholly efficient. The executive machinery is of small import if an adequate university staff of the right timber is available, the students are imbued with the proper spirit and the citizens and provincial authorities are in sympathy with the development of a *true* university. A method of governing university affairs is necessary only in order to stimulate and preserve a proper adjustment of all phases of university activity, to secure the institution against personal selfishness or undue aggressiveness of individuals and to obtain proper representation of all interests. It is surprising to find that Cambridge and Oxford conduct their affairs on republican principles whilst the American institutions are more or less comparable to monarchical governments. Cambridge University affairs are conducted practically entirely by the alumni of the institution. The American state university, with a president at the head, has a board of regents, appointed for a term of years by the governor of the state, or elected by direct vote of the people. The alumni have no voice in the government of the institution except as they may be appointed on the board of regents, or representations are made by the alumni associations to the board of regents and state legislature.

The alumni of the individual colleges which constitute the University of Manitoba are all thoroughly loyal to their colleges and filled with love and reverence for the instructors, past and present. Most of them recognize, however, the incompatibility of denominational college interests with those of general university development. If denominational colleges are to be an integral part of the state university, the activities of these individual colleges should be largely limited to theological teaching and, if so desired, to preparation for the university proper; instruction in lines of general culture including the natural sciences, philosophy, politics and other university subjects, should be provided by the university alone.

The University of Manitoba no longer confines its activities to the examination of students and the conferring of degrees, but has begun the more important part of its work, namely, the actual teaching of its students, and it is surely a more responsible undertaking to convert the raw material into finished product rather than merely to examine and put the label upon the finished product. The teaching work undertaken by the university can and will reach a far higher stage of efficiency by the elimination of duplication in instruction and by the development of broad, general, non-religious—please mark the term, not irreligious—teaching which excludes all tendency to give too early theological interpretation to new facts or view points as presented to students not yet trained to a point where they are able to draw their own conclusions from the premises presented.

It will be noted that the commissioners are instructed to report upon the relationships of the different educational institutions in the province to the provincial university. This may be difficult of adjustment. Consideration of the good of the whole university rather than that of individuals or of local or foreign precedent, together with a realization of the fact that all of the money which goes to support education is derived originally from the people and is, or should be, intended for the benefit of all, will do much to secure what is best for the province as a whole.

A university, college, or school should not be expected to provide exclusively or even largely for the teaching of manners, morals and religion. Something must be left to home influences, and with proper environment in the home and proper ac-

tivity on the part of the churches, a non-religious instruction by the state will be found *not* to interfere with the satisfactory development of religion, but to yield an intelligent citizenship which is not possible in any other way for the same expenditure of effort and capital.

As to the form of university government, no hard and fast lines can be drawn, since each community has its own local problems to solve. In general terms, however, the alumni should have a very large voice in affairs, if they maintain an active university interest and connection. They know, as no others can, what is being done in the university. They know the strong points as well as the weak in their own training. If they have developed themselves as they should after graduation, they are in a position to compare results achieved at home with those secured abroad and, when working shoulder to shoulder with the staff of the university, are capable of giving advice, assistance and support that it is not possible to obtain from any other group of citizens. The faculties certainly should have representation in the general and special conduct of affairs, in the selection of new teachers and in the formulation and realization of a general university policy. The government of the state or province should also be represented, since it has charge of the state or provincial treasury, and has to meet the detailed needs of the province, including interests other than educational. University interests should be so safeguarded, however, that no individual or political party can in any way, or for any purpose, interfere with the proper performance of its function and its natural growth. Those who are interested in the government of universities will find a number of articles in recent issues of SCIENCE by leading educationalists of the United States and a great deal can there be gained which may be of value to Manitoba, because her problems are very similar indeed to those which confront the various states of the union.

Professor J. McKeen Cattell, of Columbia University, has written a number of articles recently which are instructive and far-sighted, although, at first glance, they appear much more radical than they really are. I may quote from his article on "University Control":[1]

> In the colleges from which our universities have developed the problem of administration was comparatively simple. The faculty and the president met weekly and consulted daily; each was familiar with the work of the entire institution; a spirit of cooperation and loyalty naturally prevailed. The trustees also understood the economy of the college and were able to work intelligently for the general good. But when a university covers the whole field of human knowledge, when it is concerned with professional work in divergent directions, when it adds research and creative scholarship to instruction, when both men and women are admitted, when there are 500 instructors and 5,000 students, it is no longer possible for each trustee and for each professor to share intelligently in the conduct of the whole institution. We appear at present to be between the Scylla of presidential autocracy and the Charybdis of faculty and trustee incompetence. The more incompetent the faculties become, the greater is the need for executive autocracy, and the greater the autocracy of the president, the more incompetent do the faculties become. Under these conditions it appears that the university must be completely reorganized on a representative basis. It should not be a despotism and it can not be a simple democracy. Autonomy should be given to the schools, departments or divisions. The administrative, legislative and judicial work must be done by experts, but they should represent those whom they serve.
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> The present writer ventures to propose tentatively the following form of organization for our larger universities, to be reached as the result of a gradual evolution:
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> 1. There should be a corporation consisting of the professors and other officers of the university, the alumni who maintain their interest in the institution and members of the community who ally

[1] SCIENCE, N. S., Vol. XXIII., No. 586, pp. 475–477, March 23, 1906.

themselves with it. In the case of the state universities part of the corporation would be elected by the people. This corporation should elect trustees having the ordinary functions of trustees—the care of the property and the representation of the common sense of the corporation and of the community in university policy. The trustees should elect a chancellor and a treasurer who would represent the university in its relations with the community.

2. The professors or officers, or their representatives, should elect a president who has expert knowledge of education and of university administration. . . .

3. The unit of organization within the university should be the school, division or department, a group of men having common objects and interests, who can meet frequently and see each other daily. It should be large enough to meet for deliberation and to represent diverse points of view, but small enough for each to understand the whole and to feel responsible for it. The size of this group is prescribed by a psychological constant, its efficient maximum being about twenty men and its minimum about ten.

4. Each school, division or department should elect its dean or chairman and its executive committee, and have as complete autonomy as is consistent with the welfare of the university as a whole. It should elect its minor officers and nominate its professors. The nominations for professorships should be subject to the approval of a board of advisers constituted for each department, consisting, say, of two members of the department, two experts in the subject outside the university and two professors from related departments. The final election should be by a university senate, subject to the veto of the trustees. The same salaries should be paid for the same office and the same amount of work. The election should be for life, except in the case of impeachment after trial. The division should have financial as well as educational autonomy. Its income should be held as a trust fund and it should be encouraged to increase this fund.

5. The departments or divisions should elect representatives for such committees as are needed when they have common interests, and to a senate which should legislate for the university as a whole and be a body coordinate with the trustees. It should have an executive committee which would meet with a similar committee of the trustees. There should also on special occasions be plenums of divisions having interests in common and plenums of all the professors or officers of the university. There should be as much flexibility and as complete anarchy throughout the university as is consistent with unity and order.

Professor Cattell states in other articles[2] that in the development of universities during the initial stages the administrative autocracy of the typical college of the United States will serve its purpose as it has in the past and most effectively, provided the proper man be secured, but that he is to be replaced by some such system of control as has been advocated in the article just quoted. If the various constituent colleges of the University of Manitoba are to confine their teaching to preparation for the university and for theology, it will become necessary for the university to teach the humanities, and this can surely be done with greater success by large departments, well manned and equipped, than by the present methods. The medical college should become *in toto* what it is now *in parte*, namely, a true member of the university corporation. These points are of importance in planning for the future in regard to expenditures for buildings, equipment and site. The stimulation afforded by association of those engaged in research, study and teaching of all of the natural and physical sciences, and professions as well as of the humanities is best calculated to bring culture to the one and practicality to the other, whilst the focusing of all branches of university activity under a carefully selected and competent administration will preserve satisfactory relationships and tend to economize in time, effort and money.

UNIVERSITY FINANCES

The royal commission will probably find difficulty in inducing the citizens and pro-

[2] "The American University," *Popular Science Monthly*, June, 1902; "The University and Business Methods," *The Independent*, December 28, 1905.

vincial authorities to realize the magnitude of undertaking to provide a satisfactory university. Although Manitoba has had a university since 1877, it can not be said as yet to have made provision for it which is at all adequate.

Manitoba has now a population of about 380,000, and with all the demand on her for increased university facilities, which means expenditure for installation and maintenance, has only been able to expend approximately $80,000 for building and permanent improvement, and for maintenance $15,000 per annum (which until last year was only $6,000), with an addition of $25,000 from land grant and other sources, making a total current expenditure of $40,000 per annum.

A comparison with some of the state universities of the middle west which are comparable with Manitoba in the matter of resources, history of development and certain other conditions may be of interest. In order that those who wish to go more minutely into the various questions involved may have the opportunity of so doing, certain tables are appended. Certain of them were prepared and published in the *University of Minnesota Alumni Weekly* as the basis of an appeal to the state at large and the legislators in particular during the last session.

Minnesota had to begin in a small way and work out her educational problems from the ground, as is the case in Manitoba. Her university was founded nine years earlier than that of Manitoba, but development was going so slowly and the increased demands were so out of proportion to available facilities that the alumni and other interested individuals in the state became aroused and a campaign of general education began.

The development from 1887 to 1906 is shown. In 1887 there were only 412 students registered out of a state population of 1,180,000 and there was available $35,000 from state funds and a total of practically $70,000 from all sources, with a total student attendance per ten thousand population of 3.49. The cost to the state for educating a single student at that time was $84.94 and the total cost of the student's education was $169.24, with a total per capita cost to the people of the state of less than three cents. In 1906 the population of the state had nearly doubled, being then over two millions, the university attendance had increased to 3,956, the total funds derived from the state to $251,464.49 per annum, the total annual current expense of the university, exclusive of buildings and permanent improvements, was $542,167.49 per annum and the attendance at the university for each ten thousand of state population was twenty students. The cost to the state of educating each student had been diminished from $84.94 to $62.86 and the total cost of the education of the student decreased from $169.24 to less than $140.

The development of the State University of Illinois from 1859 to 1905 was rapid. The state appropriations for the university were increased from $60,000 per biennium (running in 1875 as low as $11,500 per biennium) to $1,153,000 in 1903 and $1,114,525 in 1905. It must be remembered, however, that the University of Chicago, Northwestern University and very many private, denominational and other colleges in Illinois were being developed synchronously and that the state appropriation for the university has been doubled since 1905.

Comparative statistics of the various state universities of the middle western states, with some of the endowed institutions, show approximately as many students at the state universities as in the endowed universities, whereas the funds up to 1905–6 were far less adequate.

For the year 1906 Minnesota had $542,-

167 for current expense, whereas the State University of Michigan, the State College of Agriculture and the State School of Mines, three institutions which correspond to Minnesota's State University, had $1,314,928 available in 1905. Wisconsin and Illinois in 1905 and Iowa and Missouri in 1906 had available the following amounts: Iowa, $376,000 to be expended in educating 1,815 students; Missouri, $571,776 to educate 2,139 students; Wisconsin, $714,138 to educate 3,151 students, and Illinois, $737,527 to educate 4,100 students.

The cost of educating a student in the various state institutions varied from $139 to $267.

Columbia, Chicago and Pennsylvania spent during 1905 or 1906, as the case might be, between $1,150,000 and $1,766,000 per annum, whilst Harvard for 1905 spent over $3,000,000 for all purposes.

During the legislative sessions of 1905–6 the various state universities became very active and their alumni and other interested individuals brought pressure to bear upon legislatures with very gratifying results. Not all of the exact figures can be obtained but by correspondence, and from other sources some approximate ideas of moneys available have been gained.

Illinois.—It will be seen that a total state appropriation of $2,207,790 was made to cover the biennial period beginning July 1, 1907. This does not include funds derived from the federal grant of $25,000 per annum, receipts from students' fees and sources other than state grants.

Iowa, which is a strictly agricultural community, and whose population is approximately 2,210,000, had available for the year 1906 a total of $550,000 derived from building tax, permanent fund, interest on endowment, fees and state appropriation. Its enrollment for the year was 2,100 students. Its permanent endowment fund, realized from the sale of land grants, amounts only to $2,240,500. The figures for 1907–8 were not yet available.

Wisconsin.—Certain particulars concerning state university expenditures in 1905 have already been quoted and later approximate statistics have been furnished by prominent members of the faculty. She has a two sevenths of a mill tax, which is expected for the years 1907–8 to bring in over $600,000 per annum, which, with other funds, will make available for university expenditures for the next biennial period over one million dollars per annum. This includes a building fund yielding $100,000 per year for the next five years.

Nebraska has a population of approximately one and one half millions, with available state university funds amounting to $590,000 for the coming year. Figures for 1906 you have already considered.

Michigan has no state university which is comparable with that in Minnesota or Wisconsin, since her school of mines and school of agriculture are separate state institutions. The exact figures for the coming biennial period are not available, but for the university proper in 1906 the total expenditure was given as $735,464.52, which included appropriations of one fourth mill tax for general university purposes. The students' fees for 1906 amounted to $233,207.79. For the coming biennial period funds of over $969,000 per annum will be available, owing to the increase of the state tax for university purposes from one fourth to three eighths of a mill.

Minnesota, whose population is now in excess of two million, has recently received much more generous financial support, for which the alumni association deserves much credit. The university has just completed during the last biennial period (1905–6, 1906–7) $874,000 worth of new buildings and equipment which does not include other permanent improvements. She has available for the coming biennial period an

amount of $2,697,000 which may be even greater, since conservatism has been exercised in the estimates of funds derived from students' fees, the state tax of 23/100 of a mill and miscellaneous receipts.

She is about to erect a $250,000 engineering building covered by state funds, a hospital costing $115,000 from a bequest of a Minnesota citizen, and is about to increase the size of her campus by a state fund of $450,000 which may be distributed over the next three years, but which doubtless will be all completely expended within the next two years, and has a further increase of campus extension fund by the donation to a hospital site fund of over $40,000 by citizens of Minneapolis. Her total expenditure for maintenance, exclusive of state grants for hospital maintenance, special investigations, library expenses, repairs, etc., will be over $663,000 per annum. Her pay-roll now amounts to over one half million dollars per annum.

The original land grant for university purposes in Minnesota was very much more generous than was realized until quite recently. The state university timber land was once supposed to have value purely for its timber, and the swamp land, when drained, as an agricultural resource. They have been found, however, to be rich in iron. The state auditor estimates that from fifteen to ninety millions of dollars will be derived from these lands, according to the method used in realizing on the ore. A conservative estimate made by him is forty-five million dollars, the annual income of which, when invested, would be available for university purposes, which in addition to her 23/100 of a mill tax, the federal grants which increase annually and students' fees, quite apart from special state appropriations, should enable her, by properly educating her students, to develop state resources, stimulate private and commercial enterprises and improve social and economic conditions. The enrollment of the State University of Minnesota this year will be upwards of 4,400 students and surely it is time now for a proper realization of responsibilities and opportunities. Development of university ideals, a comprehensive plan looking forward to the future, and in general wholesome optimism which sees the future as a definite present obligation, are necessary in order to find the university men and mechanism and the state citizenship and governmental authority ready to meet the gigantic responsibilities and opportunities involved. Minnesota University must awaken to the immediate necessity of an active preparation in order to preserve and utilize intelligently what is in the immediate future. No excuse need be made for presenting in some detail the experience of Minnesota, since her state problems have been—and bid fair to continue to be—very like those of Manitoba. Furthermore, Minnesota conditions are better understood by Manitobans than nearly any other community which is at all accessible.

UNIVERSITY SITE

Manitoba, like nearly all her sister universities, provincial, state and endowed, has been short-sighted in her original plans for location, but is valiantly endeavoring now to provide for the future. If she is to centralize teaching in sciences, arts and the professions and to establish and maintain an agricultural department, she will require several hundred acres. Every endeavor should be made to bring and keep all portions of the university in as close association as possible and this means, of necessity, the building, equipment and maintenance of lecture rooms, libraries, laboratories, museums, provision for hospital and dispensary service, workshops, horticultural, botanical, agricultural and general biological facilities for outdoor as

well as indoor experimentation. All of these interests should be associated and fostered under one university and they should be as close to a metropolis as possible. The voice of the pessimist or of the short-sighted individual should not be heeded for a moment. McGill is really cramped for space. Toronto with all the land she had originally, has not sufficient room at the present time to accommodate her new hospital. Columbia has had to move and will have to move again. Johns Hopkins University has not been able to locate all of the various departments in one group. The older universities of Europe suffer from the same failure of imagination. Minnesota has already had to buy at a very great advance in price, additional land for the agricultural department and is now doubling the size of her campus, upon which are located the other departments, at an expense of one half million dollars, and the end is not yet.

UNIVERSITY BUILDINGS

In planning buildings everything will depend upon the recommendations of the commission as to the nature, scope and methods of teaching which are to be immediately employed. Manitoba will be different from other universities if she is able to anticipate and keep up with the demands for building and equipment. She will doubtless make adequate immediate provision for those departments which are considered most essential, namely, those for which the local need and local opportunity are greatest.

No one can forecast the development of the province, but it will doubtless seem strange to outsiders, and to Manitobans themselves, as they consider it seriously, that a people with the optimism for which Manitoba is celebrated, has not long ere this made definite satisfactory provision for the education of its students along those lines which will be of most value to the development of the province. Optimism to be effective must be consistent and if the good things predicted for Manitoba come true—and we all believe that they will come true—it is time that Manitobans demonstrated an actual practical belief in their predictions by the exercise of an optimistic university policy, casting aside all short-sighted, personal, denominational, political and commercial prejudice. The prairie province will probably profit more by the experience of the states to the south of her than she will by imitating too closely the methods of the older English or European universities, since these were founded at an early period of world development in which conditions were not comparable in any degree to those of to-day. Students of public economy and social development see in the older universities much to admire in the way of tradition and in the way of culture and past accomplishment, but the very traditions and associations which appeal so much to us of the western world are really, when seen at close hand, frequently not to be differentiated from narrow prejudice which prevents them from meeting their own national or local demands and renders utterly impossible a satisfactory reconstruction so as to cope with responsibilities which a state might reasonably place upon her university. The younger universities in England, which are perfecting their professional and technical schools so rapidly, will lack for many years the intangible and often mythical something known as culture, but will furnish brains, utensils and methods which will count for far more in the total of British development. Much must be done by the older English universities if they are to keep pace with the newer universities and technical schools, although they are loath to admit that anything so new and utilitarian can in any sense rival them.

Manitoba is to be envied that within the next few months the British Association, for the Advancement of Science representing the mother country, and the American Public Health Association representing to a more limited degree and along a more limited line the countries of America, will be convening in her capital city. These distinguished visitors will be anxious to see how Manitoba is meeting her responsibilities and it is to be hoped that the royal commission may be ready to make at least a preliminary report by that time.

We alumni of this university wish to do our part in securing for our younger brothers and sisters everything which they have a right to expect from the province where they are to receive their education and where, for the most part, their life work will be done. The province has only to realize fully what it owes to itself in the way of provision for the strongest arm of provincial development, that is, its university, in order to make a beginning towards the payment of that debt. It must be a matter in which each individual citizen interests himself so that intelligent cooperative action may be taken, and in the process, not only will the total citizenship participate, but individuals will not be found wanting who will realize their opportunities and privileges of doing something for their neighbors and for their own sons and daughters by giving liberally of private funds for public good. The university should not, however, be dependent mainly upon private gifts nor should these be accepted under conditions which will initially or even in far distant years cripple in any way the utility or development of the institution which should be now, and doubtless will soon become, Manitoba's stimulus and guide to progress in all directions. When the possibilities, not merely cultural, but utilitarian, of an ideal university are recognized by the different states and provinces, there will be no need of appeal to public or private interests.

STATISTICS OF THE UNIVERSITY OF MINNESOTA, FROM "UNIVERSITY OF MINNESOTA ALUMNI WEEKLY"

Year Ending	Attendance	Expenses		Attendance per 10 M. Pop.	Cost per Student		Per Capita Cost to People of the State
		State	Total		To State	Total	
1887[3]	412	$35,000.00	$69,770.33	3.49	$84.94	$169.24	2.966 cts.
1888	491	40,000.00	52,998.04		81.47	107.93	
1889	781	50,000.00	68,214.22		64.02	87.34	
1890[4]	1002	65,000.00	135,130.86	7.70	64.87	134.86	3.840 cts.
1891	1183	65,000.00	154,809.69		54.94	130.85	
1892	1374	73,932.31	170,815.21		53.80	124 32	
1893	1620	78,665.01	177,819.85		48.43	109 76	
1894	1828	71,441.16	220,352.29		39.08	120.54	
1895	2171	155,300.16	248,473.61		71.53	114.45	
1896	2467	129,307.32	219,064.80	15.32	52.41	88.80	8.031 cts.
1897	2647	82,332.59	283,716.26		31.10	107.18	
1898	2890	98,904.78	296,483.61		34.22	102.58	
1899	2925	144,835.48	323,491.00		49.51	110.59	
1900[5]	3236	152,128.25	387,697.83	18.48	47.01	119.80	8.68 cts.
1901	3413	158,502.55	412,164.99		46.44	120.75	
1902	3656	184,030.69	419,744.97		53.36	114.81	
1903	3788	187,518.00	447,961.19		49.50	118.25	
1904	3845	174,996.19	403,465.76		45.50	104.93	
1905	3944	243,942.71	455,596.33		61.85	115.51	12.19 cts.
1906[6]	3956	251,464.49[7]	542,167.49	20.00	62.86	137.05	

LEGISLATIVE APPROPRIATIONS FOR UNIVERSITY OF ILLINOIS FROM 1869 TO 1905 INCLUSIVE

1869	$ 60,000.00
1871	130,000.00
1873	51,500.00
1875	11,500.00
1877	69,500.00
1879	24,000.00
1881	40,000.00
1883	54,500.00
1885	68,000.00
1887	71,300.00
1889	80,150.00
1891	147,300.00
1893	295,000.00
1895	439,900.00
1897	499,964.81
1899	521,900.00
1901	832,330.01
1903	1,153,000.00
1905	1,114,525.00
Total	$5,665,679.82

[3] Population, estimated, 1,180,000.
[4] Population, 1,301,826.
[5] Population, 1,751,394.
[6] Population, 2,000,000.
[7] Balance left over, $65,430.23.

TABLE OF COMPARATIVE STATISTICS, FROM "UNIVERSITY OF MINNESOTA ALUMNI WEEKLY"

Institution	Enrollment	Income			Cost per Student	Annual Library
		State	Other Sources	Total		
Minnesota, 1906	3956	$251,464	$291,703	$542,167	$139	$6,500
Michigan, 1905[8]	5734	675,284	639,644	1,314,928	229	22,500
Wisconsin, 1905	3151	486,439	227,699	714,138	226	38,643
Illinois, 1905	4100	401,000	336,327	737,527	180	35,000
Iowa, 1906[9]	1815	271,500	104,500	376,000	207	
Missouri, 1906	2139	411,000	160,776	571,776	267	10,000
Washington, 1906	1194	149,000	2,500	151,500	125	
Nebraska, 1906	2914	313,000	130,235	443,235	152	10,000
Columbia, 1906	4833			1,150,000		
Chicago, 1905[10]	4580			1,766,332		40,000
Pennsylvania, 1905[10]	2692			1,210,728		
Yale, 1905[10]	2995			888,711		
Harvard, 1905[10]	5393			3,082,103		

ABSTRACT OF APPROPRIATIONS MADE FOR THE UNIVERSITY OF ILLINOIS BY THE STATE LEGISLATURE FOR THE BIENNIUM BEGINNING JULY 1, 1907

(Exclusive of other revenues)

1

	Per Annum	For the Biennium
College of Agriculture	$ 50,000	$100,000
Feeding experiments	25,000	50,000
Experiments in corn growing	15,000	30,000
Examination of soils	25,000	50,000
Orchard investigations	15,000	30,000
Dairy investigations	15,000	30,000
Floriculture investigations	7,500	15,000
		$305,000

2

Ordinary operating expenses	$450,000	$900,000
Materials for shop practise	5,000	10,000
Increasing cabinets and collections	2,000	4,000
Purchase of books, etc., for Library	25,000	50,000
Additions to apparatus and appliances	3,000	6,000
Fire protection	1,500	3,000
Engineering College and Experiment Station	75,000	150,000
Buildings and grounds	14,345	28,690
State Water Survey	6,000	12,000
Draining, etc., on experimental farms	5,000	10,000
Department of social and political science	25,000	50,000
School of Music	3,000	6,000
Agricultural extension	6,000	12,000
Law School	15,000	30,000
Chemical Laboratory	10,000	20,000
School of Pharmacy	5,000	10,000
Graduate School	50,000	100,000
Veterinary College		30,000
School of Household and Domestic Science	10,000	20,000
Additional equipment of the water station		3,000
Increasing telephone exchange.		1,500
Enlarging general heating and light plant		35,000
For purchase of farm land		11,600
		$1,502,790

3

Physics Laboratory	$250,000
Natural History Hall	150,000
	$400,000
	$1,502,790
	400,000
	305,000
Grand total	$2,207,790

[8] These figures include the University, the College of Agriculture and the School of Mines, three institutions to take the place of Minnesota's single university.

[9] Figures for the University alone. Figures for the College of Agriculture not being available.

[10] Figures from the World's Almanac of 1905, and include annual income for all purposes.

ESTIMATED TOTAL INCOME OF UNIVERSITY OF MINNESOTA FOR THE BIENNIAL PERIOD 1907–8 AND 1908–9

State appropriation for Engineering Building		$250,000
State appropriation for enlargement of campus		450,000
State appropriation for land, School of Agriculture		76,000
State special appropriations for University School of Agriculture, Experiment Station and substations, including building, repairs, campus improvement, library and equipment		380,000
Hospital site fund contributed by citizens		40,000
Hospital building fund (Elliott estate bequest)		115,000
Hospital maintenance for 1908		25,000
Current expense, including federal grant, of	$ 60,000	
Special support fund from state	165,000	
Interest on invested funds	53,000	

Students' fees, estimated	140,000
State tax of 23/100 of a mill..	215,000
Miscellaneous receipts from University and Experiment Station about	30,000
Total per annum	$663,000
Total for the biennium	$1,326,000
Balances carried forward for expenditure in 1907–8.....	35,000
Total for biennium	$2,697,000

F. F. Wesbrook
University of Minnesota

SCIENTIFIC BOOKS

THE SCIENTIFIC RESULTS OF THE ZIEGLER POLAR EXPEDITION [1]

The scientific work of the Ziegler Polar expedition to the Franz Josef Archipelago, 1903–5, commanded by Anthony Fiala, was placed in charge of Mr. W. J. Peters, the representative of the National Geographic Society and second in command of the expedition. Entering the employ of the Carnegie Institution of Washington shortly after his return, as commander of the Magnetic Survey yacht *Galilee*, he was unable to attend personally to the reduction and to the publication of the results. The completion of the work was therefore entrusted to Mr. John A. Fleming, of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, who has put it in its present form.

The principal observations were upon the earth's magnetism, with notes and sketches of the aurora, meteorology, the tides and the topography of the archipelago, supplemented by astronomical observations for precise geographical positions. It is to be regretted that the party was not prepared to attempt more in the study of the geology and biology of the region. Mr. Fiala notes in his introduction to the volume that some interesting fossils were seen, and numerous veins of coal discovered, the latter find proving of practical as well as of scientific interest.

More than one half of the volume is devoted to the results of the observations on terrestrial magnetism. A small magnetic observatory was erected at Teplitz Bay, in which observations were made from September, 1903, to July, 1904, very near the site of the magnetic station of the Abruzzi expedition of 1900. The observatory was left standing, with the probable expectation that it will be available for future use. In view of the very extended series of results obtained by this expedition, a future series at the same point would have a greatly increased value.

In the discussion of the declination results, some interesting conclusions are drawn as to the character of the daily movement of the needle, during the several seasons of the year. By dividing the entire time over which the observations extend into periods of four weeks each, and plotting the means of the hourly values, each value based on about 240 separate readings, a series of graphs has been constructed, very clearly showing the change in the amplitude of diurnal variation with the time of the year, the times of principal maximum and minimum positions, the epochs of mean declination, and the existence and form of the secondary maximum and minimum. In a further discussion the relation of the mean yearly amplitude of the diurnal variation to the magnetic latitude is again pointed out, and the change in this relation with the epoch in the sunspot cycle is shown.

A large amount of meteorological information was collected on the expedition, which will prove useful in future discussions; its full value, however, was unfortunately affected by deficiencies in the instrumental outfit used. Two very satisfactory series of tidal observations were made at points approximately 150 miles apart. These have been arranged and discussed by Mr. L. P. Shidy, chief of the Tidal Division of the United States Coast and Geodetic Survey, who concludes that the tide wave reaches the archipelago by the two channels on either side of Spitzbergen, the one

[1] "The Ziegler Polar Expedition, 1903–1905, Anthony Fiala, Commander." Scientific results obtained under the direction of William J. Peters, representative of the National Geographic Society in charge of scientific work. Edited by John A. Fleming. Published under the auspices of the National Geographic Society by the estate of William Ziegler, Washington, D. C., 1907, 4to, pp. viii + 630, with 43 inserts and 3 maps.

flowing west of that island arriving about four hours earlier.

An attractive feature of the book is a series of lithographic reproductions of sketches by Mr. Fiala, showing the successive appearances of the aurora on three separate occasions. The series made on the night of January 23, 1904, is particularly striking.

Not the least important part of the work is the series of maps which accompanies it. Mr. Gilbert H. Grosvenor, of the National Geographic Society, has compiled from the available sources a map of the polar regions above latitude 65° north, embodying the results, and showing the routes of the various expeditions. The map survey work of the Ziegler Expedition is delineated on an excellent set of maps by Mr. Russell W. Porter, who, under the direction of Mr. Peters, had charge of that part of the work in the field.

On the whole, the amount and value of the scientific work accomplished, notwithstanding the limitations in equipment, the accidents and exigencies incident to polar exploration and the severe attendant physical conditions under which work in polar regions must be performed, are greatly to the credit of all concerned in the observational work and in the reduction and publication of the results. It must certainly be a source of satisfaction that the second Ziegler expedition under Messrs. Fiala and Peters resulted in a substantial addition to our knowledge of terrestrial physics in the polar regions.

H. W. FISK
CARNEGIE INSTITUTION OF WASHINGTON,
DEPARTMENT TERRESTRIAL MAGNETISM,
November 27, 1907

The Proteins of the Wheat Kernel. By THOS. B. OSBORNE. Published by the Carnegie Institution of Washington, D. C. 1907. Pp. 119.

This monograph gives in a clear and concise form the results of the author's extensive work as well as that of other investigators. The importance of the subject is set forth in the introductory sentence: "Of the protein substances used as food none is more important than those contained in the seeds of wheat." The proteids are discussed mainly from the analytical side, pure types are prepared, their properties studied and ultimate composition determined. The products of hydrolysis of the various proteids are also given. The "Experimental Part" is a unique feature of the work; the methods employed are described in detail, thus permitting future investigators to intelligently review the work and not remain in doubt as to the methods employed in the preparation of the various proteins. The individuality of the various proteins have not been sufficiently recognized by chemists. These compounds have all been considered of equal value from a nutritive point of view, an assumption which should be verified by exhaustive experiments.

> That a molecule of gliadin can have the same nutritive value as one of casein would seem impossible if one molecule of food protein is transformed into one of tissue protein, for in the former lysine is wholly lacking, and glutaminic acid, ammonia and proline are in great excess over the amount required to form any of the tissue proteins of which we know. It would seem probable that either the animal requires a variety of food, so that the relative proportion in which the amino-acids are available for its use shall correspond more nearly to its requirements, or that only a small part of these amino-acids are converted into its tissue proteins and the rest oxidized as such.

This report will prove of special value in suggesting new lines of work and in the interpretation of the results of previous investigations. The extensive analytical work accomplished by Osborne, together with the synthetic investigation by Fischer and others, on proteins, bids fair to give us a more complete knowledge of the composition and structure of these complex bodies which have not heretofore been expressed by chemical formulæ. Professor Osborne and the Carnegie Institution are both to be congratulated upon the publication of this valuable work, "The Proteins of the Wheat Kernel."

HARRY SNYDER

SCIENTIFIC JOURNALS AND ARTICLES

The closing (October) number of volume 8 of the *Transactions of the American Mathematical Society* contains the following papers:

Max Mason: "The expansion of a function in terms of normal functions."

Maurice Fréchet: "Sur les opérations linéaires (troisième note)."

A. G. Greenhill: "The elliptic integral in electromagnetic theory."

Also "Notes and errata, volume 8," and index of volume.

The December number (volume 14, number 3) of the *Bulletin of the American Mathematical Society* contains: Report of the September Meeting of the San Francisco Section, by W. A. Manning; "On Quadratic Forms in a General Field," by L. E. Dickson; "On the Canonical Substitution in the Hamilton-Jacobi Canonical System of Differential Equations," by D. C. Gillespie; "The Maximum Value of a Determinant," by F. R. Sharpe; "Third Report on Recent Progress in the Theory of Groups of Finite Order," by G. A. Miller; "The Dresden Meeting of the Deutsche Mathematiker-Vereinigung," by C. A. Noble; "Bryan's Thermodynamics," by E. B. Wilson; "Shorter Notices" (G. Vivanti's Funzioni Poliedriche e Modulari, by J. I. Hutchison; J. Sommer's Vorlesungen über Zahlentheorie, by G. H. Ling; L. Couturat's Les Principes des Mathématiques, by J. W. Young); "Notes"; "New Publications."

The January number of the *Bulletin* contains: Report of the October Meeting of the Society, by F. N. Cole; "On Triple Algebras and Ternary Cubic Forms," by L. E. Dickson; "Isothermal Systems in Dynamics," by E. Kasner; "On the Equations of Quartic Surfaces in Terms of Quadratic Forms," by C. H. Sisam; "Symbolic Logic" (Review of works by Couturat, MacColl and Shearman), by E. B. Wilson; "Shorter Notices" (H. Durège's Elemente der Theorie der Funktionen (fifth edition), by J. Pierpont; H. Burkhardt's Elliptische Funktionen, by J. Pierpont; Bromwich's Quadratic Forms, by Maxime Bôcher); "Notes"; "New Publications."

SOCIETIES AND ACADEMIES

THE CONVOCATION WEEK MEETINGS OF SCIENTIFIC SOCIETIES

The American Association for the Advancement of Science and the national scientific societies named below will meet at the University of Chicago during convocation week, beginning on December 30, 1906.

American Association for the Advancement of Science.—December 30–January 4. Retiring president, Professor W. H. Welch, The Johns Hopkins University, Baltimore, Md.; president-elect, Professor E. L. Nichols, Cornell University, Ithaca, N. Y.; permanent secretary, Dr. L. O. Howard, Cosmos Club, Washington, D. C.; general secretary, President F. W. McNair, Houghton, Mich.

Local Executive Committee.—Charles L. Hutchinson, chairman local committee; John M. Coulter, chairman executive committee; John R. Angell, Thomas C. Chamberlin, Joseph P. Iddings, Frank R. Lillie, Charles R. Mann, Robert A. Millikan, Charles F. Millspaugh, Alexander Smith, J. Paul Goode, local secretary.

Section A, Mathematics and Astronomy.—Vice-president, Professor E. O. Lovett, Princeton University; secretary, Professor G. A. Miller, University of Illinois, Urbana, Illinois.

Section B, Physics.—Vice-president, Professor Dayton C. Miller, Case School of Applied Science; secretary, Professor A. D. Cole, Vassar College, Poughkeepsie, N. Y.

Section C, Chemistry.—Vice-president, Professor H. P. Talbot, Massachusetts Institute of Technology; secretary, Professor Charles L. Parsons, New Hampshire College, Durham, N. H.

Section D, Mechanical Science and Engineering.—Vice-president, Professor Olin H. Landreth, Union College; secretary, Professor Wm. T. Magruder, Ohio State University, Columbus, Ohio.

Section E, Geology and Geography.—Vice-president, Professor J. P. Iddings, University of Chicago; secretary, Dr. Edmund O. Hovey, American Museum of Natural History, New York City.

Section F, Zoology.—Vice-president, Professor E. B. Wilson, Columbia University; secretary, Professor C. Judson Herrick, University of Chicago.

Section G, Botany.—Vice-president, Professor C. E. Bessey, University of Nebraska; secretary, Professor F. E. Lloyd, Desert Botanical Laboratory, Tucson, Arizona.

Section H, Anthropology and Psychology.—Vice-president, Professor Franz Boas, Columbia Uni-

versity; secretary, George H. Pepper, American Museum of Natural History, New York City.

Section I, Social and Economic Science.—Vice-president, Dr. John Franklin Crowell, New York City; secretary, Professor J. P. Norton, Yale University, New Haven, Conn.

Section K, Physiology and Experimental Medicine.—Vice-president, Dr. Ludvig Hektoen, University of Chicago; secretary, Dr. Wm. J. Gies, College of Physicians and Surgeons, Columbia University, New York City.

Section L, Education.—Vice-president, Hon. Elmer E. Brown, U. S. Commissioner of Education; acting secretary, Professor Edward L. Thorndike, Teachers College, Columbia University, New York City.

The American Society of Naturalists.—December 28. President, Professor J. Playfair McMurrich, University of Toronto; secretary, Professor E. L. Thorndike, Teachers College, Columbia University, New York City. Central Branch, president, Professor R. A. Harper, University of Wisconsin; secretary, Professor Thomas G. Lee, University of Minnesota, Minneapolis, Minn.

The American Mathematical Society. Chicago Section, December 30, 31. Chairman, Professor Edward B. Van Vleck; secretary Herbert E. Slaught, 58th St. and Ellis Ave., Chicago, Ill.

The American Physical Society.—President, Professor E. L. Nichols, Cornell University; secretary, Professor Ernest Merritt, Cornell University, Ithaca, N. Y.

The American Chemical Society.—December 27–January 2. President, Professor Marston T. Bogert, Columbia University; secretary, Professor Charles L. Parsons, New Hampshire College, Durham, N. H.

The Association of American Geographers.—December 31–January 1. Acting-president, Professor R. S. Tarr, Cornell University, to whom correspondence should be addressed; secretary, Albert P. Brigham, 123 Pall Mall, London, Eng.

The Entomological Society of America.—Secretary, J. Chester Bradley, Cornell University.

The Association of Economic Entomologists.—December 27, 28. President, Professor H. A. Morgan, Knoxville, Tenn.; secretary, A. F. Burgess, Columbus, Ohio.

The American Society of Biological Chemists.—December 30–January 2. President, Professor Russell H. Chittenden, Yale University; secretary, Professor William J. Gies, College of Physicians and Surgeons, Columbia University, New York City.

The Society of American Bacteriologists.—December 31–January 2. Vice-president, F. D. Chester, Delaware Agricultural College, Newark, Del.; secretary, Professor S. C. Prescott, Massachusetts Institute of Technology.

The American Physiological Society.—Beginning December 31. President, Professor W. H. Howell, Johns Hopkins University; secretary, Professor Lafayette B. Mendel, 18 Trumbull St., New Haven, Conn.

The Association of American Anatomists.—January 1–3. President, Professor Franklin P. Mall; secretary, Professor G. Carl Huber, 1330 Hill St., Ann Arbor, Mich.

The American Society of Zoologists.—Central Branch. Secretary, Professor Thomas G. Lee, University of Minnesota, Minneapolis, Minn.

The Botanical Society of America.—December 31 and January 1, 2 and 3. President, Professor George F. Atkinson, Cornell University; secretary, Dr. D. S. Johnson, Johns Hopkins University.

The Botanists of the Central States.—Business Meeting. President, Professor T. H. Macbride, University of Iowa; secretary, Professor H. C. Cowles, University of Chicago, Chicago, Ill.

The American Psychological Association.—December 27, 28. President, Dr. Henry Rutgers Marshall, New York City; acting secretary, Professor R. S. Woodworth, Columbia University, New York City.

The Western Philosophical Association.—Secretary, Dr. John E. Bowdoin, University of Kansas, Lawrence, Kans.

The American Anthropological Association.—December 30, January 4. President, Professor Franz Boas, Columbia University; secretary, Dr. Geo. Grant MacCurdy, Yale University, New Haven, Conn.

The American Folk-lore Society.—December 30–January 4. President, Professor Roland B. Dixon, Harvard University; secretary, Dr. Alfred M. Tozzer, Harvard University, Cambridge, Mass.

Other national societies will meet as follows:

NEW HAVEN

The American Society of Zoologists.—Eastern Branch. December 26, 28. President, Dr. C. B. Davenport, Cold Spring Harbor, N. Y.; secretary, Professor W. L. Coe, Yale University, New Haven, Conn.

The American Society of Vertebrate Paleontologists.—December 26–28. President, Professor Bashford Dean, Columbia University; secretary, Professor Frederick B. Loomis, Amherst College, Amherst, Mass.

NEW YORK

The American Mathematical Society.—December 27, 28. President, Professor H. S. White, Vassar College; secretary, Professor F. N. Cole, Columbia University.

ALBUQUERQUE, N. M.

The Geological Society of America.—December 30–January 4. President, President Charles R. Van Hise, University of Wisconsin; secretary, Dr. Edmund O. Hovey, American Museum of Natural History, New York City.

ITHACA

The American Philosophical Association.—December 26, 28. President, Professor H. N. Gardiner, Smith College; secretary, Professor Frank Thilly, Cornell University, Ithaca, N. Y.

NEXT SUMMER, AT SOME PLACE TO BE DETERMINED

The Astronomical and Astrophysical Society of America.—President, Professor Edward C. Pickering, Harvard College Observatory; secretary, Professor Geo. C. Comstock, Washburn Observatory, Madison, Wisconsin.

THE PHILOSOPHICAL SOCIETY OF WASHINGTON

The 638th meeting of the society was held November 9, 1907, President Hayford in the chair. Mr. C. E. Waters, of the Bureau of Standards, presented by invitation a paper entitled "The Standard Cell." The speaker reviewed briefly the earlier efforts to fix adequate standards of electrical measurements, the unit of resistance having first received attention, mention being made of the work of the British Association in this connection. It was noted that present requirements demand higher accuracy in the standards of measurement. The development of the standard cell, down to the present time, was briefly reviewed and the defects of those formerly used were pointed out, especial reference being made of their lack of stability.

The principal feature in the preparation of a standard cell is that of securing materials of requisite purity. The methods employed to secure satisfactory materials and the results obtained by Messrs. Wolff and Waters at the National Bureau of Standards, in preparing the H type of standard cell were spoken of at considerable length.

Several chemical compounds were tested in the experiments. The difficulties of obtaining mercurous and cadmium sulphates were especially pointed out, and the methods devised for obtaining them in a sufficiently pure state were described. Before setting up the cells the materials were carefully cleaned. More accordant results were obtained by amalgamating the platinum terminals. The cells were measured in an electric bath in order to maintain a steady temperature. The thermo-electric effects were eliminated by the methods of observation. The experiments showed that mercurous sulphate can be obtained in several ways that will give good electromotive force properties. Standard cells are now found constant enough to be depended upon for a considerable length of time. The final conclusion was that satisfactory cells can now be set up by different observers of different materials.

The second paper of the evening was presented by Mr. C. W. Burrows on "The Reduction of Iron to a Magnetically Neutral State for Permeability Measurements." In the experiments described several different kinds of iron were used. The test pieces were 50 cm. in length and varied in square cross-section from 0.3 mm. to 1 cm. The ballistic method was used in the demagnetization tests. Numerous diagrams were exhibited showing permeability, induction effect, effect of temperature and of vibration, and also curves of tests of non-homogeneous iron.

As a matter of definition iron is in a magnetically neutral state when it is free from all residual induction and yields as readily to positive as to negative magnetizing forces. A small magnetic needle or a movable test coil will give evidence of any residual induction, but they tell nothing as to any difference in susceptibility to positive and negative forces. A long series of experiments leads to the conclusion that iron is in the neutral state when the change in induction observed on reversal of a given magnetic force is a maximum. Imperfect demagnetization always results in a lower induction. The following points are noted:

1. The higher the rate of reversal or fre-

quency of the demagnetizing current, the less complete is the demagnetization. This effect of frequency is more marked in large bars and in soft iron.

2. A sufficient range for the demagnetizing current carries the iron from just above the "knee" of the induction curve down to the lowest value to be studied. Hard iron and steel require a relatively higher initial current than soft iron.

3. The demagnetizing current is best reduced in such a way that the induction decreases approximately uniformly.

4. One initial demagnetization produces the same results as a separate demagnetization before each step in the induction curve.

5. Even many thousands of reversals of the magnetizing force to be studied do not accomplish the effect of demagnetization.

After iron has been demagnetized the apparent induction observed increases for a few reversals, passes through a maximum, and then decreases, approaching a lower limit asymptotically. This final limiting value is *defined* as the true induction.

The influence on permeability determinations of temperature, small mechanical vibrations, magnetic viscosity, and the terrestrial field are investigated, and it is shown experimentally that these elements must be considered if an accuracy of one per cent. is to be obtained. Their influence is greatest in the steep part of the induction curve.

R. L. FARIS,
Secretary

THE BIOLOGICAL SOCIETY OF WASHINGTON

THE 433d meeting was held October 19, 1907, with President Stejneger in the chair.

The single paper of the evening was offered by Dr. E. D. Merrill, on "The Geographic Distribution of Philippine Plants." The subject-matter presented was the outcome of five years' experience of the author and others, during which large collections had been made and many of the islands visited. He first discussed the relations of the Philippine flora with that of Hawaii and northern Australia, noting the interesting fact that of many Australian types found, all were confined to the high mountains of the island of Luzon. He then considered the relations with Celebes, Borneo, Formosa and the Asiatic continent. The great number of plants common to Luzon and Formosa he thought might indicate a former land connection. Similarly it was thought that the Philippines might have been connected with Queensland. Although the flora of the high mountains was Asiatic, it was evident that the great migrations had come from the south.

A brief discussion followed on the distribution of Philippine animals. Dr. Stejneger gave various reasons for considering reptiles, batrachians and mammals the best guides in determining former land connections. Judging by the reptiles, there is no indication of a connection between Formosa and Luzon since the Jurassic.

Dr. Lyon, speaking of the mammals, said this group gave no indication of a connection with Formosa. The mammals of the mountains of Luzon are so peculiar that it is difficult to say what their relationships are, but their strongest leanings seem toward Australian types.

Mr. Oberholser spoke of the birds, of which there are about 700 known species representing 175–200 genera. They may be divided into Cosmopolitan, Palearctic and Philippine groups. The latter comprises the following subdivisions: (1) East Asian, with few species, (2) Australasian, with rather few, (3) Celebesian, with somewhat more, (4) Bornean, with a still greater number, (5) Indo-Malayan, with the largest of all, (6) Endemic, not considered.

Dr. Gill said the freshwater fishes of the Philippines were of little interest in the present connection, most of them being Asiatic and many of them widely distributed. They show no relationship with Australian forms.

The 434th meeting was held November 16, 1907, President Stejneger in the chair. The evening was taken up with an account by Dr. B. W. Evermann, of "Freshwater Mussels and the Pearl Button Industry" along the Mississippi River, illustrated with specimens of shells, buttons, pearls, etc.

WILFRED H. OSGOOD,
Recording Secretary pro tem

THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON

The meeting of November 19, 1907, was addressed by Professor Marshall H. Saville, Columbia University, on "Archeological Researches on the Coast of Ecuador." Professor Saville, who has charge of the G. G. Heye expedition, plans to examine the antiquities of the entire region between Mexico and Peru, taking up in order the coast and interior valleys, and thus far, two seasons have been spent in western Ecuador, between the 4° south latitude and 1½° north latitude. Two cultures anciently occupied the coast; the Manabé, in the dry region of the south; and the Esmaraldas in the humid region on and north of the equator. The ruins of the former are situated on the slopes of forested foothills which are watered with night fogs that descend about midway on their flanks. The houses, which were light wooden structures capable of resisting earthquakes, were placed on terraces excavated from the hillsides resembling the trincheras of Mexico. The remains are a few slabs sculptured in bas relief and numerous great stone seats of U-shape resting on the back of a puma. Mounds occur in which skeletons and pottery are found. The remains of Esmaraldas are exposed on the sea bluffs and along the river banks. Enormous deposits of artifacts are found along the coasts for two hundred and fifty miles, and on the Atacamanes River are great deposits in the alluvium, showing on sections two lines of human remains, pottery, etc. In these deposits were upright tubes of pottery which were coffins. Numerous gold objects and some emeralds were found by the expedition. A remnant of the Caiapas Indians living in northern Ecuador, about sixty miles north of the town of Esmaraldas, were visited and photographed.

The thanks of the society were extended to Professor Saville for his interesting paper.

Walter Hough,
General Secretary

THE NEW YORK ACADEMY OF SCIENCES. SECTION OF BIOLOGY

On May 13, 1907, the section met at the American Museum of Natural History for an interesting session. The papers were as follows:

Brief Account of the Expedition to the Fayoum, Egypt: Professor Henry F. Osborn.

A summary of the valuable results of this expedition in search of *Palæomastodon* and *Arsinoitherium* was given and illustrated by a fine series of stereopticon views. A detailed account of the expedition has already been published in Science.[1]

The Supernumerary Chromosomes of Hemiptera: Professor Edmund B. Wilson.

In striking contrast to nearly all forms heretofore described, the genus *Metapedius* presents a considerable range of variation in the individual number of chromosomes, though the number is constant in each individual. The following numbers have thus far been observed in a total of 30 individuals (spermatogonia in the males, ovarian cells in the females). *M. terminalis,* males 22, 23, females 22, 25; *M. femoratus,* males 22, 23, 26, females 24, 26; *M. granulosus,* males 23, 26, 27 (?), females 26. The variation is thus seen to be independent of sex; and it is not a casual fluctuation within the individual, since the individual number is constant and in the male is definitely correlated with the number present in the maturation-divisions. Thus with 22, 23 or 26 spermatogonial chromosomes the first spermatogonial division shows, respectively, 12, 13 or 16 chromosomes—a relation shown constantly and in a large number of cells. Study of the conditions shown in the males leads to the conclusion that all individuals possess a fundamental or type group of 22 chromosomes that are always present and show the same general arrangement in the first division. To these may be added in certain individuals one or more "supernumerary chromosomes" which, like the idiochromosomes, differ in behavior from the others in failing to couple at the time of general synapsis, dividing as univalents in the first division where they appear smaller than the bivalents (as will be shown hereafter in photographs). Thus are explained the peculiar numerical relations above stated—

[1] N. S., Vol. XXV., No. 639, March 29, 1907.

e. g., 16 chromosomes in the first division include ten bivalents and six univalents (two idiochromosomes and four supernumeraries). In the second division the supernumeraries almost always unite with the idiochromosome-bivalent to form a compound element; and the facts indicate that the individual members of this complex may undergo an asymmetrical distribution to the spermatozoa, which probably gives the explanation of the variations observed in the somatic numbers of different individuals. The new proof given by the facts of the genetic identity of the chromosomes, and their possible bearing on certain phenomena of heredity, were indicated.

Variations in the Leaf Type of Liriodendron Tulipifera during a Season's Growth: Dr. L. HUSSAKOF.

The leaves were collected from a single tree during three successive summers beginning with 1904, and their variations in form statistically studied. During 1905 and 1906 "average samples" (about 500 leaves, representing all parts of the tree) were collected at intervals of about a month and systematically tabulated. It was found that at the end of May the six-pointed type of leaf constitutes over half the total foliage (.58 in 1905; .65 in 1906), and that the four-pointed type is totally absent. During the next month there is a remarkable growth of four-pointed leaves so that at the end of June they constitute over 50 per cent. of the total foliage. The six-pointed leaves become reduced to about 35 per cent. of the total. During the remainder of the summer these figures vacillate only within about 5 per cent. The leaves with 8, 10, 12 and 14 points were also studied; each makes up only a small per cent. of the total foliage, the last being very rare.

The talk was illustrated by charts and specimens.

Orthogenesis in Gastropods: Professor A. W. GRABAU. (Illustrated with lantern slides.)

No abstract of this paper has been received.

On October 14, 1907, the section met at 8:15 P.M., in the American Museum of Natural History. The evening was devoted to brief reports on summer work by members of the section. Among others the following members addressed the section: Professor W. M. Wheeler: "A Study of Ants in Switzerland"; Professor N. L. Britton: "Recent Explorations in Jamaica"; Professor H. E. Crampton: "A Second Journey to the Society Islands."

Professor E. B. Wilson also gave a brief account of the summer work at Woods Holl, and described some interesting experiments made by him on the structure of living cells.

Brief reports were also made by several other members of the section, after which the meeting adjourned.

On November 11, 1907, after a short business meeting, at which sectional officers for 1908 were elected, the following papers were read:

A Paleontological Trip to Northwestern Nebraska: Professor HENRY F. OSBORN.

Professor Osborn reported upon two excursions, during the seasons of 1906 and 1907, into the Lower Miocene beds of northwestern Nebraska, variously known as Arikaree, Harrison and Rosebud.

The recognition of these beds as containing fauna transitional between the Oligocene and Lower Miocene is due to the successive explorations of Hatcher, Barbour, Peterson, Matthew and Thomson. The lower division (Lower Harrison, Lower Rosebud) is somewhat more recent than the true Upper Oligocene of France. The upper division (Upper Harrison, Upper Rosebud) may also represent the beginning of the Miocene, and is sharply defined from the lower division by the absence of certain mammals and the presence of others. The formation as a whole is a very grand one, extending continuously over 200 miles east and west; varying in thickness from 1,200 feet in the west to 800 feet farther east. It is, in fact, one of the most extensive, most readily distinguished, and most definable of the Tertiary series, but it still awaits accurate definition and distinction, especially from overlying beds, partly owing to the fact that it has been embraced under the "Arikaree," which practically includes a considerable part of the Miocene series.

In the region of Agate, Sioux County, Nebr., the first discoveries of fossils were made by Mr. James H. Cook and his son, Mr. Harold Cook. This region has been especially explored by Carnegie Institute parties under Mr. O. A. Peterson and Mr. W. H. Utterback. The Monroe Creek, Lower Harrison, and Upper Harrison divisions are very distinctly separated from each other geologically and faunistically. The remarkable deposit known as the "Agate Spring Quarry" is about forty feet below the summit of the Lower Harrison and its fauna, and has been especially described by Mr. Peterson. This is on the same level as the Dæmonelix Beds of Barbour, and is characterized by the presence of *Moropus, Syndyoceras, Oxydactylus, Diceratherium* (smaller and larger species), *Parahippus, Blastomeryx, Dinohyus, Thinohyus* and *Promerycochœrus. Steneofiber,* a castoroid, is quite abundant and is frequently found in the Dæmonelix spirals. The origin of these spirals still remains a very difficult problem. The Upper Harrison is sharply defined by the appearance of the large *Merycochœrus* in the upper levels, by the presence of cameloids of three or four types. *Dinohyus* persists in the lower levels but disappears above.

A more exact determination of the geological and faunal characters of these beds will mark a great advance in our knowledge of the Tertiary series.

A fine series of lantern slides illustrated the paper.

The Ptarmigan—Living and Dead: Frank M. Chapman.

Both the distribution and color of ptarmigans are of special interest. In distribution, we have a circumpolar group extending its range southward on the Arctic Alpine summit of mountain ranges with isolated groups (for example, *Lagopus mutus,* in the Alps and Pyrenees, and *Lagopus leucurus,* in the Rocky Mountains of Colorado and New Mexico) occupying restricted areas at the south, which it is probable they reached at some time during the Glacial Period. The fact that the birds of these south Alpine islands are specifically like their representatives at the north indicates absence of differentiation since their isolation, and consequent great stability of color characters.

The ptarmigan's seasonal changes of plumage were described at length and were said to furnish one of the most conclusive proofs of the necessity for protective coloration known among birds.

Particular attention was called to the transitional autumn plumage which, in defiance of the laws of molt, is interpolated between the known summer plumage and the white winter plumage, to carry the bird from the end of the nesting season to the season of snowfall in October. If the winter plumage were to be acquired at the end of the nesting season, when molt is apparently a physiological necessity, the bird would be white before the coming of snow.

All the changes in plumage, it was asserted, were accomplished by actual feather loss and growth, no basis being observed for the theory of change of color in the individual feather.

The paper was illustrated with specimens and a series of slides showing the White-tailed Ptarmigan and its haunts on the summits of the Canadian Rockies in Alberta.

The Distribution of the Juncos, or Snow Birds, on the North American Continent: Dr. Jonathan Dwight, Jr.

The birds of the genus *Junco* are widely distributed, occupying in the breeding season the whole of Canada, the higher parts of the Appalachian, Rocky and Coast ranges of mountains, and the pine forests of Mexico and Central America. They fall quite naturally into several large groups that differ widely in plumage and are also farther divisible into lesser groups that possess characters more or less intermediate. Intergradation between the various forms seems to be complete and one view is to consider them all geographical races of one species, but a view more in harmony with the apparent facts, is to recognize several of the groups as species and to consider the intermediates either as hybrids or as races, or perhaps as both. A blackheaded junco, for instance, would seem to be specifically distinct from a red-headed bird, because each possesses

a character not found in the other, while mere color variations, attributable to climatic conditions, point to geographical races.

Whether Mendelian principles will or will not explain the complicated plumage characters of the juncos, here at least there seems to be a promising field for experimental research to supplement the facts derived from field study.

The paper was illustrated by a large series of specimens brought together by Dr. Dwight for his investigations, and representing collections in all parts of the country.

The meeting then adjourned.

ROY WALDO MINER,
Secretary of Section

THE TORREY BOTANICAL CLUB

THE club met at the American Museum of Natural History on November 12, 1907. The meeting was called to order by Dr. J. H. Barnhart. Dr. E. B. Southwick was elected chairman. In the absence of the secretary, Miss W. J. Robinson was elected secretary *pro tem.* Eleven persons were present.

The following scientific program was presented:

Demonstration of Regeneration in Drosera: WINIFRED J. ROBINSON.

Miss Robinson observed regeneration in the leaves of plants of *Drosera rotundifolia* which she had under observation for experimental purposes, at the propagating house of the New York Botanical Garden, in August, 1907. Young plants appeared upon old and apparently dead leaves which were attached to the plant and were at first thought to be seedlings which had penetrated the leaf tissue in their growth. Sections showed that this was not the case but that the young plant grew from the cells of the old tissue which had remained in an embryonic condition. No formation of callus was observed. Regeneration occurred with equal facility from blade or petiole of the leaf or from the flower stalk. The first leaves of the young plant bear no tentacles, but later leaves are exactly like those of the parent plant. The roots appear after the stem has attained some size and are at first diageotropic, but later bend toward the substratum.

Drosera is not mentioned in recent literature upon regeneration but Spencer in his "Principles of Biology," 1867, referred to the subject as a matter of common knowledge. Naudin recorded the appearance of a bud upon the upper surface of the leaf of *D. intermedia* in *Ann. Sci. Nat.*, II., **14**: 14, *pl. 1, fig. 6*, 1840. Planchon gave his observations upon certain "monstrous flowers" of *D. intermedia* in *Ann. Sci. Nat.*, III., **9**: 86, *pl. 5 and 6*, 1853. His observations were verified by various later writers. The most extended study of regeneration in *D. rotundifolia* was made by Nitschke, professor at Westphalia, whose investigations were printed in the *Bot. Zeit.* **8**: 239, 237, 245, 1860. He studied plants in the bogs and observed that the age of a plant could be determined by the successive rings of young plants about it.

Photographs of regenerating plants and of sections showing relation of the regenerating tissue to the parent plant were shown, also specimens in alcohol, demonstrating the origin of young plants from petiole and blade of leaf and from the flower stalk.

Notes on Tumboa (Welwitschia): NORMAN TAYLOR.

After a short account of the history and synonymy of *Tumboa Bainesii* (*Welwitschia mirabilis*), a general description of the mature plant was given. Attention was called to the peculiar characters of *Tumboa,* which is exogenous in the two cotyledons and the 2–4-merous perianth, endogenous in the parallel-veined leaves and six stamens, angiospermous in the general structure of the flower, and gymnospermous in the naked ovule and typical "cone" flowers.

Particular mention was made of the seedling, of which there are two now growing at the New York Botanical Garden. In germination the two ligulate cotyledons appear first above the soil, followed by the two nepionic leaves, at first erroneously supposed to develop into the only two leaves that the plant ever has during the conjectural one hundred years of its life, but this interpreta-

tion of the foliage was subsequently corrected in the "Genera Plantarum." Photographs were shown illustrating the two cotyledons and also the position and character of the two nepionic leaves. The latter, which will subsequently develep into the long, tentacle-like leaves of the mature plant, are at first small and linear, springing up directly between the cotyledons, which they closely resemble, and at right angles to them. It was noted that sometimes these leaves were pressed close together, and at other times spread as far apart as possible; that is, they were prostrated on each side of the axis of the plant. From being thus flattened out on the soil they would gradually become erect and finally touch their inner surfaces together. In seeking an explanation of this peculiarity several ideas suggested themselves, the true one seeming to be that the movement of the leaves was a direct response to the presence or absence of water. When they were prostrate they were simply wilted, and it was the water that made them stand erect. On account of the typically xerophytic aspect of even these seedling leaves one would not suspect that they were wilted, there being no external evidence of any loss of turgidity, except the change of position above described.

Some Recent Species of Plantago: E. L. Morris.

Plantago is the genus of plants containing our common plantain. Probably these plants are by most people considered nothing more than weeds, but in contrast to these as weeds there is a large group of species typically at home and indigenous in the semi-arid regions of our west and southwest. The species for a long time were included under one name, a name which was applied originally to the South American species found only in Patagonia.

The speaker called attention to a series of sheets of some fifteen species which, he stated, were until 1900, or a few years preceding, classified under the name of *Plantago patagonica* Jacquin, or, to speak more definitely, since 1845 there had been but three specific segregations from this composite and decidedly variant group. One of these was described by Dr. J. K. Small, another by Miss A. M. Cunningham and another by Dr. E. L. Greene. The misapplication of the name of Miss Cunningham's species to a specimen received in exchange, led to the study of the group and the segregation of the species into two distinct types, those with relatively long and definitely acute bracts, in distinction from those with typically short and definitely obtuse or rounded bracts. Among the group of perennial species of the genus, reference was made to a species from Mt. Shasta, formerly included in a species typical only of the extreme southwest. Reference was then made to a recent species from Alaska, characterized by the marked septation or partitioning of the leaf hairs. A most notable fact regarding this species is that the next important collection of it was made in Montana. It appears that no collections of this species have been made along the Rocky Mountain regions between the Yukon and Montana stations. The last group of species noticed was that belonging to the typical South American subgenus *Plantaginella,* represented there by several species. A species recently reported from Mexico belongs unquestionably to this group, though quite out of its formerly known range. The chief characteristic of this species is the unifloriate spike, which, preceding anthesis, is enclosed within a prominent sheathing bract. Then followed a brief discussion of variation in our common eastern species, the facts being noted that certain forms may soon require a segregation with the rank of species.

A brief discussion followed the presentation of each of the topics of the evening.

Winifred J. Robinson,
Secretary pro tem.

THE SCIENCE CLUB OF WELLESLEY COLLEGE

The club held its 90th regular meeting on October 8. Dr. Lincoln W. Riddle presented a paper on "Some Fungi Parasitic on Insects." The paper took up two groups of fungi: *Entomophthora* and *Empusa* parasitic on flies, grasshoppers and various hairy cater-

pillars; and *Cordyceps,* parasitic especially on various subterranean insect-larvæ. Attention was called to the economic importance of these fungi, and to the possibility of the use of *Empusa Anlicæ,* parasitic on the caterpillars of the brown-tail moth, in fighting the moth-pest. The paper was illustrated by specimens of the various fungi described.

At the 91st meeting, held on November 5, Dr. Caroline B. Thompson reviewed the recent work of McClung, Montgomery, Wilson, Stevens and others, on the chromosomes of insects, and especially Wilson's theory of the heterochromosomes as sex determinants.

MARY T. HOLLISTER,
Secretary

THE ELISHA MITCHELL SCIENTIFIC SOCIETY OF THE UNIVERSITY OF NORTH CAROLINA

THE 173d meeting was held in the main lecture hall of the Chemical Laboratory, Tuesday evening, November 12, 1907, at 7:30 o'clock. Dr. W. C. Coker described "A Trip to Porto Rico." The talk was fully illustrated with lantern slides and a large collection of botanical specimens.

A. S. WHEELER,
Recording Secretary

DISCUSSION AND CORRESPONDENCE

LODGE'S ETHER AND HUYGHENS'S GRAVITATION

THE alarming density of the ether which Sir Oliver Lodge believes must be taken into consideration is liable to leave one more open-mouthed with astonishment than did Lord Kelvin's famous molasses-candy ether, even if open mouths are suggested in connection with the latter. But 10^{12} grams per cubic centimeter is not an every-day experience, consciously at least. I have thought of it in relation to Huyghens's ingenious mechanism for gravitation. If a body rotates in a fluid *lighter* than itself, it must in virtue of centrifugal force and Archimedes's principle, *sink* toward the center of rotation. Electronists insist that the ether is absolutely stationary: but suppose that it rotated just a little with the earth. We may then write for the buoyancy per cubic centimeter $\rho_e\omega_e^2R$ and for the centrifugal force per cubic centimeter of submerged matter $\rho_m\omega_m^2R$, where ρ, ω, R denote density, angular velocity and radius of curvature, respectively. In other words

$$\omega_e^2/\omega_m^2 = \rho_m/\rho_e = 10^{-12};$$

that is, if the angular velocity of the ether were but one millionth that of the earth about the sun, there would be no centrifugal force to compensate gravitation. The brilliant experiments of our recent medallists show that observationally, $\omega_e = \omega_m$. The electronist gets around this by the principle of relativity. But if, granting Lodge's ether as little as $\omega_m/10^6$ would imply conditions comparable with gravitation, one can not escape a little uneasiness unless, from the interpenetration of matter and ether, ρ_m is ultimately, *i. e.,* per corpuscle, much larger than ρ_e. As a whole, however, a fixed ether would be the only satisfactory inference.

CARL BARUS

BROWN UNIVERSITY,
PROVIDENCE, R. I.

METAGENESIS IN INSECTS

IN a recently issued paper by Professor Montgomery[1] attention is called again to the condition approaching an alternation of generations in the case of insects with complete metamorphosis:

> Among insects with a more or less complete metamorphosis the crawling larva becomes a quiescent pupa; then from a series of points of the hypodermis of the pupa the organs of the imago are formed, while all the remaining tissues of the pupa degenerate by histolysis and then become ingested by phagocytes. Therefore an adult fly or moth or wasp is an individual quite different from the pupa, an individual produced asexually by the conjunction of a series of buds. This is in every sense as truly metagenetic as the development of a medusa from a polyp (Montgomery).

This is, in a way, true (the word larva, however, should be substituted for pupa in most of the above, as the histoblasts from which the adult parts are derived are already distinguishable and have begun development in the larva), and is suggestive. And the fact

[1] *Trans. Texas Acad. Sci.,* Vol. IX., pp. 75–94.

should have more attention than it seems to get. The whole matter of metamorphosis in insects has been looked at too much from the angle of the systematists, who have found "incomplete" and "complete" metamorphosis a convenient taxonomic character, and of the nature study teachers, who have found it a subject of fascinating interest to children. The true biologic significance of the process has been pretty consistently overlooked. Montgomery does well to recall attention to it and to suggest an interpretation of it of great interest.

However, before accepting this interpretation, or any other, or following it too far, we should be sure we know the actual state of affairs represented to us by the phrase "complete metamorphosis." This commonly suggests, first, the externally obvious, apparently violent and radical changes from larva to pupa to adult, and, second, the interesting internal phenomena of the histolysis of the larval parts and histogenesis of the imaginal parts. But we are very likely to let a type or example of this total performance represent to us the whole range of the phenomenon, which is misleading. For as a matter of fact every gradation can be found among insects from the simple going over, with little or considerable transformation, of larval parts into adult parts, as taken to be characteristic of "incomplete" metamorphosis, to the radical disintegration and disappearance of the larval parts with the fundamental new building of the imaginal parts from isolated histoblasts, taken to be characteristic of and common to all insects of "complete" metamorphosis.

During the last few years, various students in my laboratory (particularly Mr. Powell) and I myself have given some special attention to the phenomena of insect metamorphosis, and have been able to break down any inherited belief of ours (or belief acquired from tradition and text-books) of the discontinuity of "incomplete" and "complete" metamorphosis. We have found insects of incomplete metamorphosis (Hemiptera) showing some of the characteristic phenomena of complete metamorphosis and insects of complete metamorphosis (Coleoptera) showing characteristics of incomplete metamorphosis. And these not as individual variant or aberrant cases, but as conditions characteristic of the development of species.

That is, if the insects with more specialized complete metamorphosis, as flies, ants, etc., are to be looked on as metagenetic in character (*i. e.*, "with a life cycle consisting of two or more individuals with alternation of sexual and asexual reproduction"), and the insects with most generalized incomplete metamorphosis as having a continuous (non-metagenetic) life cycle, the question arises as to where, in the insect class, the difference first appears. And if the whole process of metamorphosis differs in its most specialized and its most generalized states only in degree; if a complete series of intergrading or connecting states exists (as really does); where is the opportunity to interpret this process in the case of certain insects as true metagenesis, and in the case of others as a true continuous non-metagenetic life cycle?

Vernon L. Kellogg
Stanford University, Cal.

BOTANICAL TEXT-BOOKS

It is a pretty dull week when some one does not put out a new botanical text-book intended for high-schools, colleges and universities, and not infrequently these consist of 300 to 600 pages each, covering a wide range of topics. The great diversity of training given in the colleges of our country and of Europe, makes it next to impossible for any capable man to produce a book all sections of which will fit a large number of teachers. I think we may well learn a lesson regarding this multiplicity of books from the teaching of English literature.

Instead of compelling each member of a class to purchase complete sets of Burke, Patrick Henry, Webster or Clay, select speeches of these men are printed separately, which are inspiring and can be used by the students according to their different tastes. So here in botany, why should not some one, by this plan, prepare a considerable number of pamphlets, each suited to the needs of some teacher, which his own judgment will lead him to

select. It usually discourages a student somewhat to buy a large text-book, one half or one third of which is used in his classes, and the rest omitted. W. J. BEAL

SPECIAL ARTICLES

THE PROBABLE ORIGIN AND PHYSICAL STRUCTURE OF OUR SIDEREAL AND SOLAR SYSTEMS[1]

MAINLY because of the very high, and for certain reasons inadmissible, temperature heretofore obtained when Newton's law of radiation is employed, astronomers and physicists hold that this law can not be used for determining the effective surface temperature of the sun.

That Newton's law of radiation is just as true for the sun as is the law of gravitation, and that the sun's surface temperature can only be determined by means of this law will now be demonstrated.

Let us conceive that the sun's total radiant energy S (per unit of time) is concentrated in an ether vibration at the sun's center. Let the temperatures t_0 and t be taken as the measures of the intensity of vibration at the distances r_0 and r; we can then at once write

$$\left(\frac{S}{t_0 r_0^2}\right) = \left(\frac{S}{t r^2}\right), \tag{1}$$

hence

$$t_0 = t\left(\frac{r}{r_0}\right)^2. \tag{2}$$

Now let us conceive that a thin spherical shell of lampblack having the radius r_0, and coinciding with the sun's surface, receives and transmits in each unit of time the total energy S, the temperature t_0 of this shell will then be the same as the temperature of the sun's surface, and the temperature t in any exterior similar shell of radius r must necessarily be such as to satisfy equation (2), for to assume any gain or loss through the substitution of the total energy S given out by the surface shell in place of the energy S given out by the central vibration would be contrary to the law of the conservation of energy.

Now to find t_0 the temperature t, at the earth's distance from the sun, must first be found, and *just here is where inadmissible errors have been committed in past determinations.*

I offer the following extremely simple method for determining the absolute temperature of space:

Let D denote the diameter of a mirror (or objective) having the focal length F, the linear diameter d of the sun's focal image will then be $d = 2F \tan \theta$, in which θ is the angular semi-diameter of the sun. (For our present purpose d depends only on F and θ and is independent of D.) Let T denote the measured absolute temperature in the sun's focal image, then, if we neglect for the present the effects due to atmospheric absorption, we can at once write for a theoretically perfect telescope

$$\frac{T}{t} = \left(\frac{D}{d}\right)^2. \tag{3}$$

The expression for the absolute temperature of space is therefore

$$t = T\left(\frac{d}{D}\right)^2. \tag{4}$$

Now let a denote the factor by which T must be multiplied in order that the product shall equal the surface temperature t_0 of the sun; we then have

$$a\frac{T}{t} = a\left(\frac{D}{d}\right)^2 = \frac{t_0}{t} = \left(\frac{r}{r_0}\right)^2, \tag{5}$$

from which we find

$$a = \left(\frac{d}{D}\right)^2\left(\frac{r}{r_0}\right)^2, \tag{6}$$

in which all the quantities are known. The expression for the effective surface temperature t_0 of the sun is therefore

$$t_0 = t\left(\frac{r}{r_0}\right)^2 = aT. \tag{7}$$

My observational work has been carried on with the aid of three mirrors which I constructed to continue investigations under way at the time of my departure from the Lick Observatory. The first two of these telescopes are briefly described in No. 539 of the *Astronomical Journal;* the third mirror has an aperture of two feet and a focal length of three feet. The definition of this last-men-

[1] Extract from a still unfinished paper.

tioned telescope is such that images of the faintest-known isolated stars can (with the aid of a powerful magnifying glass) be plainly seen on a photographic plate exposed for less than five minutes in the focus. When this instrument is turned to the sun all known metals are melted and vaporized. A circular hole equal in size to the sun's focal image is almost instantly formed in a thin plate of sheet-iron held in the focus; by taking a much thicker piece the vaporization of the boiling-iron image of the sun (held in place by capillary action with the bordering plate of cold iron) can be observed at leisure until a hole is again formed.

To obtain a known value of T for a measured value of D the aperture of this mirror was gradually reduced (by means of circular openings, of different diameters, cut in cardboards placed centrally over the mirror) until a strip of platinum plate could just be melted when held in the focal plane. With the sun at 54° zenith distance, in a clear atmosphere, the corresponding diameter was found to be eighteen inches.

Neglecting for the present the corrections due to aberrations and absorptions in the telescope and in the atmosphere, we have the following approximate values for substitution in formulas (4), (6) and (7):

$$D = 18.0 \text{ in.}$$
$$d = 0.337 \text{ in.}$$
$$\left(\frac{r}{r_0}\right)^2 = 44000$$
$$T = 2000° \text{ C.}$$

The uncorrected results are, therefore,

Absolute temperature of space $= t = 0°.7$ C.
Effective surface temperature of the sun $=$
$t_0 = 30800°$ C.

The instrumental corrections (due mostly to absorption at the silver surface of the mirror) increase the value of t from 0°.70 to 0°.75. The effect of atmospheric absorption on the intensity of ether vibrations must next be considered. My information on this subject is based upon a long series of photographic observations (on certain fixed stars) which I made, reduced and discussed more than sixteen years ago; the work (8vo, pp. 89) was published in 1893 under the title "Terrestrial Atmospheric Absorption of the Photographic Rays of Light" and forms No. 3 of "Contributions from the Lick Observatory." The tabular data on page 86 of this work give, for 54° zenith distance, the intensity (or brightness) 0.61, the brightness at the zenith being unity. If the temperature of the sun's focal image varies according to the same law, the value of t is increased from 0°.75 to 1°.23 in the zenith; this value must, finally, be further increased by a still undetermined correction for absorption in the zenith; if we *assume* a one-fourth increase in the temperature due to this cause we have finally

Absolute temperature of space $= 1°.5$ C.
Effective surface temperature of the sun
$= 66000°$ C.

It should be explicitly stated that the formulas are derived for the theoretical case of the earth *without* an atmosphere, or of observations made in free space. In actual observations T denotes *the rise in temperature* above the temperature of the surrounding medium and, therefore, is equal to the absolute temperature of the sun's focal image minus the absolute temperature of the air at the place of observation.

J. M. Schaeberle
Ann Arbor,
November 24, 1907

A NOISELESS ROOM FOR SOUND EXPERIMENTS

For many experiments in laboratories of physics, physiology and psychology a place is needed from which all, or nearly all, external sound can be excluded. An absolutely noiseless room opens up numerous new possibilities of research, especially in the fields of sound physiology and psychology. For this reason rooms have been constructed in many laboratories, but all the attempts to produce a noiseless room that are known to the writer are more or less unsuccessful, with the exception of the room to be described here.

The room to which reference is made is in the Physiological Institute of the University of Utrecht, Holland. It has been constructed under the direction and has been used by Professor H. Zwaardemaker, to whom I am in-

debted for permission to publish the present description.[1]

The room is located on the top story of the laboratory building devoted to physiology. This floor of the building is little used, except for the sound room, and there are, consequently, few footsteps and other noises in the immediate neighborhood of the room. The location of the room at a distance from the street prevents to some extent the transmission of vibrations and jars of the street traffic. Moreover, the room is an inside one, separated from the building walls by other rooms or a corridor, although in its construction, as will be noted below, provision is made for thorough ventilation and the entrance of sunlight. The other rooms of the laboratory on the same floor are comparatively little used, and by surrounding the sound room they help to isolate it.

A vertical section of the room from north to south is given in the accompanying figure. It will be seen that in the construction a small room has been formed to the south of the sound room. The ceiling of the small room is the roof of the building. The roof has been cut to form a window which admits light and air. The small room has been constructed with walls nearly as sound-proof as the larger room, and for some work may be used as an additional place for sound experiments. When closed, it also serves to act as a dead air space between the larger room and the building wall and roof.

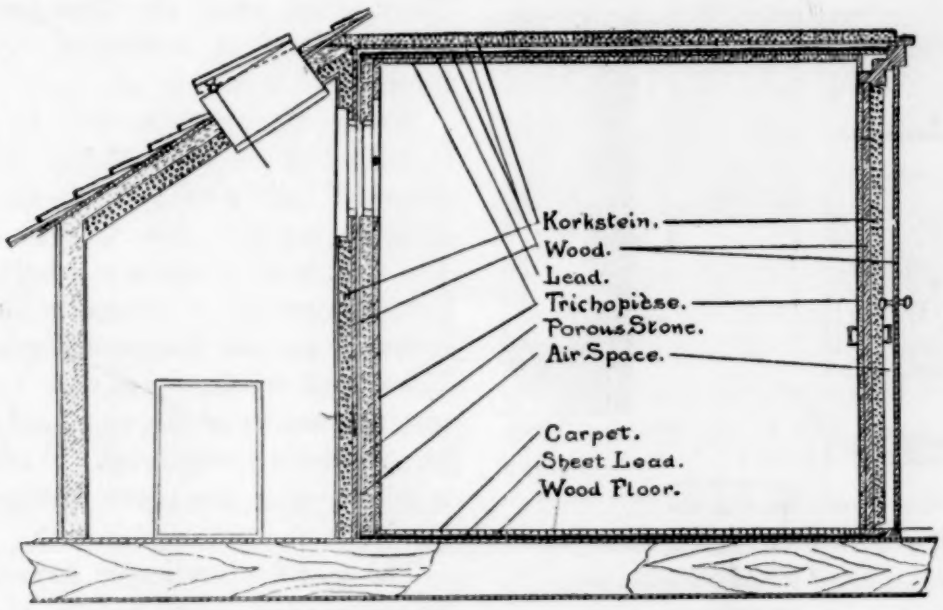

FIG. 1

The inside measurements of the sound room are as follows: Length, 228 cm.; width, 220 cm.; height, 228 cm.

The sides of the room are built of six layers. From the inside outwards the layers are as follow: (1) *Trichopièse,* about 5 cm. thick. This is a felt-like material made of horse hair, and from experiments it has been found to have very low coefficients of conduction and reflection of sound. This layer is covered with a net on the inner side (to keep the hair from falling) and then fastened with nails to the second layer, which is more stable. (2) Porous stone, 7.5 cm. thick. This part of the wall does not rest directly on the floor, but is isolated from the floor by a layer of sheet lead,

[1] At the International Physiological Congress, Heidelberg, August, 1907, Professor Zwaardemaker read a description of the room and showed lantern slides of the plans of construction. Later, the writer had an opportunity of examining the room in the laboratory at Utrecht. A full description of the construction is to be published in the *Zeitschrift f. Ohrenheilkunde.* The proof of this article was in the writer's hands at the time of writing the present account.

3 mm. thick. Next there is (3) a dead air space from 2 to 3 cm. thick. Layer 4 is a wood partition, 2.5 c.m. thick. The outermost layer (6) is a special composition of ground cork, *Korkstein,* 6 cm. thick. The outer surface of the last layer is plastered, probably mainly for appearance. The space between layers 4 and 6 is filled with a mixture of ground cork and sand. The thickness of this mixture is 4 cm. The total thickness of the walls is, therefore, about 11 inches.

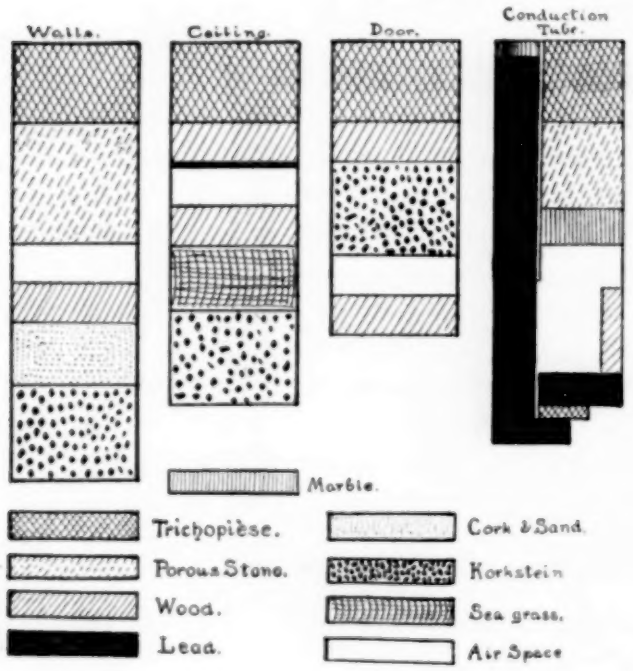

FIG. 2

The ceiling is more simply made, but it has an analogous "double-wall" construction. From within outwards there is (1) *Trichopièse,* (2) wood ceiling, to which the *Trichopièse* is fastened and which in turn rests on the porous stone of the inside layer of the walls, (3) sheet lead, 3 mm. thick, (4) an air space, (5) a second wood ceiling, which is covered with (6) asphalt paper, (7) sea grass and (8) *Korkstein.*

The floor is the least satisfactory part of the construction. The floor of the old room had to be used. To prevent vibrations passing from board to board the joints were sawed through and the crevices thus made were filled with lead. The whole floor was then covered with a layer of lead, 3 mm. thick, and over this a very thick (1 cm.) carpet has been placed. At times a second carpet is also used. Had the original floor been of marble or cement it is probable that the two layers (lead and carpet) would have been as satisfactory as the six layers of the walls.

The door is double. The outer part opens on the corridor. It is an ordinary door, made of wood, but accurately fitted with felt. The inner door is composed of three layers. The middle layer is wood, the inner or room layer is *Trichopièse,* and the outer layer is *Korkstein.* This inner door opens into the room. There is the usual air space between the two doors. The door is part of one of the long sides of the room.

Nearly opposite the door is a small rectangular window, 38 by 45 cm. This opens into the small adjoining room to the south and is directly opposite the window in the roof. The roof window opens to admit light and air, but the opening is covered with a fine gauze screen to exclude insects and especially moths. When both windows are open the sun can get into all corners of the room and the room may be partially ventilated. With doors and windows open the room is thoroughly ventilated.

The sound stimuli may have their origin in or outside the sound room. If the source of the sound is in an adjoining room the apparatus is placed in a cabinet, isolated from the floor by a lead plate and felt, and covered with the same materials. This isolation still further decreases the chance of these noises or tones entering the room through floor, ceiling or walls except in the manner that is desired.

For experiments in which it is necessary to have the origin of the sound stimuli at a distance from the subject means are needed for conducting the sound into the room. For this reason a hole was bored through one of the walls and a copper tube inserted. This tube is fastened to a marble plate, which in turn is fastened to the second layer, porous stone, of the inner wall. The wood partition is here omitted and a plate of lead, 2.5 cm. thick, is used for the outer part of the wall. To close the copper tube lead plugs were made, one of which is solid, a second has a single opening, 1.5 cm. diameter, and the third has two open-

ings, each 0.8 cm. diameter. The solid lead plug serves to keep the room sound-proof if it is not necessary to conduct the sound from without; the second and third give opportunity of introducing one or two sound stimuli, respectively.

The room is fitted with electric light and wires for telephone and other electrical purposes.

The location of the window, on the southern side of the room, makes it possible to have the room lighted by the sun and a thorough ventilation may be secured in the intervals of a series of experiments. One thing has not been solved in the construction, viz., the ventilation of the room during a series of tests. The room is large enough to hold one person for, say, a half hour without discomfort from lack of oxygen, and the use of porous material in the construction may make it possible to remain a longer time without ill effect.[2] For a series of tests on tones a half hour is sufficient time if we do not have to deal with a condition of the ear analogous to the adaptation of the eye. If time is needed for the "adaptation" of the ear perhaps some further scheme of ventilation may be required. On this point, the adaptation of the ear, we have no information and one of the possibilities of the room is the discovery of such adaptation.

When in the room, some, not all, persons experience peculiar sensations from the ear (drum?), corresponding to the sensations in slightly compressed air. There is a distinct feeling of pressure which is subjective and which disappears so soon as a sound is made, or sound stimuli are given.

The noiselessness of the room is shown by the fact that one hears a subjective buzzing, similar to but of less intensity than the buzzing produced by large doses of quinine. Many normal people can also hear their own heart sounds. It is true that their own heart sounds can be heard by some in rooms not noiseless, but this is not the case with many normal individuals except after very violent exercise. In the room a few swings of the leg or arm is often sufficient to make the heart sounds quite distinct. Other body noises may also be heard. If a movement of a few inches in extent is made, such as lightly brushing the foot over the carpet or a free movement of the arm, the sound is distinctly audible. So audible are these noises that one must be careful not to move when experiments are in progress. A further proof of the noiselessness of the room is to be found in the fact that a shell held to the ear does not appear to give forth any sound. The tones for which the shell is resonant are absent. It should be mentioned again here that the felt-like lining of the room effectually stops all sound reflection. Whatever sounds are produced or brought into the room are in this respect simple; they cease when the vibration reaches the wall.

To keep the room fresh and clean, in addition to the entrance of sunlight and fresh air, dust and other dirt are removed by a mechanical cleaner—the so-called compressed air cleaner—and it is disinfected by formalin vapor.

In experiments during the past three or four years the room has been used in its various conditions of evolution and in its final form has proved to be most satisfactory. For many years it will doubtless be a standard for the construction of similar rooms in other institutions.

SHEPHERD IVORY FRANZ
GEORGE WASHINGTON UNIVERSITY
GOVERNMENT HOSPITAL FOR THE INSANE

[2] On this point I failed to make inquiries.

SEVENTH INTERNATIONAL ZOOLOGICAL CONGRESS—SECTION OF PALEOZOOLOGY

FOR the first time in the history of the International Zoological Congress, a section of paleozoology was organized and met during the Boston convention of the congress, August 19–24. Early in the year a circular announcing the formation of this section was sent to paleontologists of this and other countries from the office of the organization chairman, Professor H. F. Osborn.[1] This circular called attention to the unusual opportunity afforded

[1] Owing to Professor Osborn's absence in Egypt, many omissions in the sending of this circular occurred.

by the congress for seeing the great paleontological collections of the Eastern United States and to the further opportunity which the meeting of American with European paleontologists would afford for the discussion of some of the broader problems of the science. The response to the invitation was a gratifying one; such a goodly number of paleontologists attended the congress, and so much was the need of such a periodic gathering of the workers in this science felt, that the permanency of the section is assured. These meetings will be looked forward to as the opportunity for establishing closer personal relations with fellow paleontologists of distant lands and for a discussion of those questions of our science which are of more than local interest.

The meetings of the section were scheduled for Tuesday and Wednesday mornings, August 20 and 21, from 10 A.M. to 1 P.M., but it was found necessary to hold additional sessions on Thursday and Friday mornings. The first meeting was called to order by the organization chairman, Professor H. F. Osborn. Professor Charles Depéret, of the University of Lyons, France, was elected first chairman of the section, and Professor A. W. Grabau, of Columbia University, New York, secretary. Professor Gustav Steinmann, of the University of Bonn, was elected chairman for the sessions of Thursday and Friday.

The principal address of the meeting was delivered by Professor C. Depéret, on Wednesday morning. It was given in French, the title being "Les migrations des faunes tertiaires entre l'Europe et l'Amerique." Two other addresses on the broader aspects of the science were made, one by Professor Gustav Steinmann in German, on "Die Bedeutung der Paläontologie für die Abstammungslehre," on Wednesday, and the other on Friday, by Professor H. F. Osborn, on "Evolution as it appears to the Paleontologist."

The complete list of papers presented before the section and the order of their presentation was as follows:

Tuesday, August 20.

Professor A. Gaudry: "Patagonie et Antarctique." (Read by Professor H. F. Osborn and since published in Science.)

Professor W. B. Scott, Princeton University: "The Zoogeographical Relations of the Miocene Mammals of Patagonia."

Dr. W. J. Sinclair, Princeton University: "The Santa Cruz Typotheria."

Professor H. F. Osborn, American Museum of Natural History: "Zoogeographical Relations of Northern Africa in the Upper Eocene."

Wednesday, August 21.

Address by Professor Charles Depéret, University of Lyons, France: "Les migrations des faunes tertiaires entre l'Europe et l'Amérique."

Professor Gustav Steinmann, University of Bonn, Germany: "Die Bedeutung der Paläontologie für die Abstammungslehre."

Dr. W. J. Holland, Carnegie Museum, Pittsburg: "A Preliminary Account of the Pleistocene Fauna discovered in a Cave opened at Frankstown, Pennsylvania, in April and May, 1907."

Professor T. D. A. Cockerell, University of Colorado: "The Miocene Fauna of Florissant, Colorado."

Mr. O. A. Peterson, Carnegie Museum: "Preliminary Notes on some American Chalicotheres."

Professor A. W. Grabau and Miss Margaret Reed, Columbia University: "Mutations of *Spirifer mucronatus*."

Thursday, August 22.

Dr. P. E. Raymond, Carnegie Museum: "The Clymenia Fauna in the American Devonian."

Professor C. Depéret, University of Lyons, France: "Sur un nouveau genre 'Lophiaspis.'"

Mr. C. H. Sternberg: "*Hesperornis regalis*, the Royal Bird of the West."

Dr. F. W. True, U. S. National Museum: "On the Correlation of North American and European Genera of Fossil Cetaceans."

Friday, August 23.

Professor H. F. Osborn, American Museum of Natural History: "Evolution as it appears to the Paleontologist." (Since printed in full in Science.)

Professor A. W. Grabau, Columbia University: "Value of the Protoconch and Early Conch Stages in the Classification of Gastropoda."

Professor R. S. Lull, Yale University: "The Evolution of the Ceratopsia."

Dr. E. Douglass, Carnegie Museum: "The Oligocene Fauna of Montana, with Sections of the White River Beds at White Bed, Montana, and the Little Badlands in North Dakota." (By title.)

Professor R. T. Jackson, Harvard University: "Studies of Fossil Limulus." (By title.)

DR. C. R. EASTMAN, Museum of Comparative Zoology: "Cranial Structure of Dipterus and Related Genera." (By title.)

Dr. O. P. HAY, American Museum of Natural History: "Fossil Turtles of North America." (By title.)

Professor H. F. OSBORN, American Museum of Natural History: "A Means of Estimating the Age of the Mastodon and other Proboscidia." (By title.)

At the Friday session a resolution was adopted, that it was the sense of the section of paleozoology, that the time was ripe for the organization of a Society of American Paleontologists, to include vertebrate and invertebrate paleozoology and paleobotany. A committee was appointed, with Professor H. F. Osborn as chairman, to confer with the officers of the Society of Vertebrate Paleontologists with a view to disbanding that society, or merging it with the larger body, and to correspond with all teachers of, and workers in, paleontology in North America, with the view to the formation of the new society.

Before the final adjournment of the section on Friday, Professor Osborn, in behalf of the local committee, and of the American members of the section, expressed great pleasure in being able to welcome the distinguished foreign paleontologists present, and assured them that American paleontologists greatly appreciated their efforts towards making this meeting such a success. Professor Steinmann, in reply, expressed the appreciation on the part of the foreign delegates, of the welcome given them, and further expressed the hope that this meeting might be the first of many others for the benefit of all concerned.

A. W. GRABAU, *Secretary of the Section*

THE AMERICAN SOCIETY OF BIOLOGICAL CHEMISTS. SECTION K—PHYSIOLOGY AND EXPERIMENTAL MEDICINE—AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. BIOLOGICAL SECTION OF THE AMERICAN CHEMICAL SOCIETY

Preliminary announcement pertaining to the Chicago meetings, December 30 to January 2

FOUR sessions of the Biochemical Society, three sessions of Section K, of the American Association for the Advancement of Science, and one session of the Biological Section of the American Chemical Society will be held during convocation week. The provisional schedule of the meetings of these three organizations is appended.

Monday, December 30

1:30 P.M.—Meeting of the Council of the American Society of Biological Chemists.

2:30 P.M.—Business session of the American Society of Biological Chemists, followed by reading of papers.

Tuesday, December 31

9:30 A.M.—Joint session of the American Physiological Society and the American Society of Biological Chemists.

2:30 P.M.—Vice-presidential address by Simon Flexner, retiring chairman of Section K of the American Association for the Advancement of Science. Subject: "Recent advances and present tendencies in pathology," followed by a joint session of the American Physiological Society and Section K of the American Association for the Advancement of Science.

(No meeting of the Biochemical Society on Tuesday afternoon.)

Wednesday, January 1

9:30 A.M.—General session of the American Chemical Society in affiliation with Section C (Chemistry) of the American Association for the Advancement of Science, including (at about 9:45) the address of the president of the American Society of Biological Chemists and chairman of the Biological Section of the American Chemical Society, Russell H. Chittenden, on the subject: "Some of the Present-day Problems of Biological Chemistry," followed by a joint meeting of the Biological Section of the American Chemical Society and the American Society of Biological Chemists.

1:00 P.M.—Meeting of the Sectional Committee of Section K.

2:00 P.M.—Symposium on Immunity, under the auspices of Section K of the American Association for the Advancement of Science, with the following program:

Introductory remarks by the chairman, Ludvig Hektoen.

M. J. Rosenau and John F. Anderson: "Anaphylaxis and its Relation to Immunity."

V. C. Vaughan: "Hypersusceptibility and Immunity."

Preston Kyes: "The Hemolysins of Animal Toxins."

William W. Ford: "Artificial Immunity to Glucosides."

S. P. Beebe: "The Differentiation of Homologous Proteids by Serum Reactions."

Frederick G. Novy: "Immunity in Spirochetal Infections."

H. T. Ricketts and L. Gomez: "Immunity in Rocky Mountain Spotted Fever."

E. C. Rosenow: "Virulence of Pneumococci in Relation to Phagocytosis."

G. F. Ruediger: "The Mechanism of Streptococcus Immunity."

Mazyck P. Ravenal: "Immunity in Tuberculosis."

H. Gideon Wells: "Chemical Aspects of Immunity."

(No meeting of the Biochemical Society on Wednesday afternoon.)

8:30 P.M.—Smoker, Biological Chemists with the Anatomists and Physiologists.

Thursday, January 2

9:30 A.M.—Meeting of the American Society of Biological Chemists, with an executive session before adjournment.

2:30 P.M.—Joint session of the Society of American Bacteriologists and Section K of the American Association for the Advancement of Science.

Details of local arrangements during convocation week, including reference to railroad rates, hotels, special announcements by the Chicago committee for the guidance of visitors, etc., have been published in a pamphlet issued from the office of the Permanent Secretary of the American Association for the Advancement of Science, copies of which may be obtained, at request, from Dr. L. O. Howard, Smithsonian Institution, Washington, D. C.

Copies of the biochemical programs will be forwarded to the members of the Biochemical Society about December 23, and may be obtained after that date from

WILLIAM J. GIES,
Secretary

437 WEST 59TH STREET,
NEW YORK CITY,
December 9, 1907

ORGANIZATION OF AN AMERICAN SOCIETY OF AGRONOMY

IT is requested by the undersigned that all persons interested in agronomy join with them in a meeting during the coming holiday season at Chicago for the purpose of organizing an American Society of Agronomy. The meeting for organization will be held Tuesday morning, December 31, in the buildings of the Chicago University, the particular place of meeting to be announced later.

Although this meeting is called for the same period during which the sessions of the American Association for the Advancement of Science will be held in order to secure better attendance, it will be determined at such time whether the organization shall be a section of this association, an affiliated society, or take some other form. A suggestive constitution and by-laws will be submitted in order that business may be hastened and as much time as possible be given to the reading of papers even at this first meeting. Eight to ten papers have already been offered. Titles and abstracts or the papers themselves should be sent at the earliest date possible either to Alvin Keyser, University of Nebraska, Lincoln, Nebr., or to M. A. Carleton, U. S. Department of Agriculture, Washington, D. C.

C. A. Alvord
Alfred Atkinson
E. D. Ball
Wm. P. Brooks
C. P. Bull
M. A. Carleton
E. C. Chilcott
L. A. Clinton
W. R. Dodson
J. F. Duggar
G. H. Failyer
F. D. Gardner
J. N. Harper
C. G. Hopkins
T. F. Hunt
Wm. D. Hurd
Alvin Keyser
B. W. Kilgore
E. R. Lloyd
T. L. Lyon
M. F. Miller
E. G. Montgomery
R. A. Moore
L. A. Moorhouse
H. A. Morgan
C. L. Newman
W. H. Olin
C. V. Piper
W. J. Quick
P. H. Rolfs
A. D. Shamel
J. H. Shepperd
C. D. Smith
L. H. Smith
A. M. Soule
W. J. Spillman
R. W. Thatcher
J. D. Tinsley
G. H. True
Edw. B. Voorhees
H. J. Wheeler
J. A. Widtsoe
C. G. Williams

SUBSCRIPTIONS FOR THE LAMARCK MEMORIAL

AMERICAN naturalists are responding to the invitation of French naturalists to join in the work of erecting a monument in Paris to Lamarck. The American members of the international committee, consisting of Messrs. Agassiz, Osborn and Dean, have not as yet, however, received a sum substantial enough to indicate adequately the interest which Americans have always displayed in the works of Lamarck, or the part which America should play in the building of this monument to the founder of the evolution theory. Up to the present time there are forty-two subscribers, and the total amount raised is $497.

At least $1,000 should be sent to France to represent worthily the zoological interests of this country.

Among the subscribers are Messrs. Agassiz, Mayer, Montgomery, Sigerfoos, H. L. Bruner, Osborn, Osburn, Gage, Allis, Dean, Brewer, Mary Rathbun, Thaxter, Dachrowski, Nachtrieb, Grover, Beal, Parker, Birge, Bigelow, Clarence H. Mackay, Woodward, Kellogg, Schuchert, Lee, Armstrong, N. Y. Academy of Sciences, Martha Bunting, Holland, Rathbun, Walcott, C. F. Cox, Gill, Wagner, Whitman, New York Zoological Society, Philadelphia Academy of Natural Sciences, Metcalf, Biological Society of Washington, Townsend, Hargitt.

Subscriptions and letters of inquiry should be addressed to Professor Bashford Dean, Columbia University, New York.

SCIENTIFIC NOTES AND NEWS

WE record with deep regret the death of Lord Kelvin on December 17.

THE Royal Society of Edinburgh has elected as British honorary fellows, Sir A. B. W. Kennedy, F.R.S., Sir E. Ray Lankester, K.C.B., F.R.S., Dr. J. A. H. Murray and Professor C. S. Sherrington, F.R.S.; foreign honorary fellows have been elected as follows: Professor Emil Fischer, Berlin; Dr. G. W. Hill, New York; Professor F. W. G. Kohlrausch, Charlottenburg; Professor H. F. Osborn, New York; Professor I. P. Pavlov, St. Petersburg; Professor G. Retzius, Stockholm; Professor A. Righi, Bologna and Professor L. J. Troost, Paris.

THE Geological Society of France has elected Dr. C. R. Eastman, paleontologist at Harvard University, in charge of fossil vertebrates, to foreign membership in the society.

M. WALLERANT has been elected a member of the Paris Academy of Sciences in the section of mineralogy.

A BRONZE cut of President Eliot has been placed in the Harvard union. It is the work of the French medalist, Leon Deschamps, and is the original from which were taken the bronze medals made in connection with the John Harvard celebration.

Nature states that the executive committee of the National Physical Laboratory has appointed Mr. G. W. Walker, official assistant to the professor of natural philosophy in the University of Glasgow, as superintendent of the Eskdalemuir Observatory. Mr. Guy Barr, of Christ's College, Cambridge, has been appointed to an assistantship in the metallurgical and chemical department of the National Physical Laboratory.

DR. ROBERT BELL, chief geologist of the Canadian Geological Survey, was the guest of honor at the banquet of the Canadian Camp, held recently at Hotel Astor, New York City.

DR. WILLIAM R. BROOKS, director of the Smith Observatory and professor of astronomy at Hobart College, Geneva, N. Y., recently delivered his illustrated lecture on "Comets and Meteors," at Trinity College, Hartford; and at Wellesley College, Mass.

AN expedition from the Desert Laboratory, including among its members Dr. D. T. MacDougal, Mr. Godfrey Sykes, Dr. W. T. Hornaday, of the New York Zoological Garden, and the Honorable J. M. Phillips, game commissioner of Pennsylvania, has recently traversed the region between Tucson and the Gulf of California. The geographical investigations centered at the Desert Laboratory were extended to include the Pinacate volcanoes, which lie near the Gulf of California in Sonora, and a general survey of plant dis-

tribution was made. A number of sunken craters, some of which were a mile in diameter and several hundred feet in depth, were discovered and measured, and material for the compilation of a map of the region was obtained. In addition to somewhat unexpectedly valuable data on the occurrence and distribution of desert plants and animals, splendid specimens of the big horn and antelope were secured, together with important information as to their habits and general behavior in this secluded region.

Nature says "Professor Bedson last June completed his twenty-fifth year as professor of chemistry at the Armstrong College, Newcastle-upon-Tyne. The event was the occasion of many congratulations and suitable presentations. In addition to the celebration arranged last summer, we notice from the report of the principal of the college that the council has 'deemed it only fitting to mark the occasion, and its profound appreciation of Professor Bedson's exceptional services to the college, by unanimously voting him a "jubilee" vacation of six months, to take effect in the course of the coming year, together with a sum of £200.' We congratulate Professor Bedson, and commend the course of action adopted by the Newcastle authorities to the notice of other college councils."

We regret to record the death of Sir James Hector, F.R.S., the British geologist, at the age of seventy-three years; of Admiral McClintock, the British Arctic explorer, at the age of eighty-eight years, and of Professor T. Barker, who formerly held the chair of mathematics at Owen's College, at the age of sixty-nine years.

The Michigan Academy of Science will hold its fourteenth annual meeting at Ann Arbor, Michigan, on April 2, 3 and 4, 1908. The titles of all papers to be presented at this meeting should be sent to the vice-presidents of the different sections before March 1, 1908. The officers of the academy are: President, Mark S. W. Jefferson, Ypsilanti; Acting Secretary-Treasurer, Walter G. Sackett, Agricultural College; Librarian, G. P. Burns, Ann Arbor. Vice-Presidents: Agriculture, A. C. Anderson, Agricultural College; Botany, W. E. Praeger, Kalamazoo; Geography and Geology, E. H. Kraus, Ann Arbor; Sanitary Science, J. G. Cumming, Ann Arbor; Science Teaching, S. D. Magers, Ypsilanti; Zoology, A. G. Ruthven, Ann Arbor.

The Physical Society, London, held its third annual exhibition of electrical, optical, and other physical apparatus at the Royal College of Science, South Kensington, on Friday evening, December 13, from seven to ten o'clock.

The Smithsonian Institution has published a fourth edition of meteorological tables. The publication of meteorological, physical and geographical tables is in furtherance of a policy adopted as early as 1852 by Secretary Henry, two years after the establishment of the Smithsonian weather service. In the preparation of the volume the institution was aided by Professors Alexander McAdie and Cleveland Abbe of the U. S. Weather Bureau.

Bulletin No. 33, from the Bureau of American Ethnology, by Ales Hrdlicka, entitled "Skeletal Remains suggesting or attributed to Early Man in North America," reviews the Calaveras, Lansing, Nebraska and other crania which have been supposed by various writers to indicate the existence of crania of low type in North America. The author reaches the following conclusion: "The various finds of human remains in North America for which geological antiquity has been claimed have been thus briefly passed under review. It is seen that, irrespective of other considerations, in every instance where enough of the bones is preserved for comparison the somatological evidence bears witness against the geological antiquity of the remains and for their close affinity to or identity with those of the modern Indian. Under these circumstances but one conclusion is justified, which is that thus far on this continent no human bones of undisputed geological antiquity are known. This must not be regarded as equivalent to a declaration that there was no early man in this country; it means only that if

early man did exist in North America, convincing proof of the fact from the standpoint of physical anthropology still remains to be produced."

THE London *Times* states that the president of the Liverpool School of Tropical Medicine, Sir Alfred Jones, has received a short report from the Blackwater Fever Expedition of the Liverpool School, dated October 10, from Blantyre. The expedition, consisting of Dr. Wakelin Bannaii and Dr. Yorke, sailed from Marseilles in August last. They report that suitable laboratories have been placed at their disposal by the government of British Central Africa at Blantyre and at Zomba. Six days after the arrival of the expedition at Blantyre two cases of Blackwater fever occurred on the Shire Highlands Railway. The expedition visited the cases at once, and kept them under close observation until recovery occurred. The British government are defraying a portion of the cost of the Blackwater Fever Expedition.

A COURSE of popular lectures on natural history and travel, under the auspices of the Illinois State Museum of Natural History, will be given in the Arsenal Auditorium, Springfield, Ill., on Saturday evenings at eight o'clock as follows:

November 30—"Diamond Mining" (illustrated), by A. R. Crook, Ph.D., curator, Illinois State Museum of Natural History.

December 7—"Greater Steps in Human Progress," by W J McGee, LL.D., director of the St. Louis Public Museum.

December 14—"Zoological Collecting in British East Africa" (illustrated), by C. E. Akeley, Field Museum, Chicago.

January 4—"Mt. Pelé and the Destruction of St. Pierre" (illustrated), by E. O. Hovey, Ph.D., American Museum of Natural History, New York City.

January 11—"The Canadian Rockies" (illustrated), by C. S. Thompson, commercial agent, Illinois Central R. R., Milwaukee.

ACCORDING to the Paris correspondent of the *British Medical Journal* an interesting ceremony took place on November 19 in the Clinic Charcot. In the presence of M. Briand, the minister of public instruction, Dr. Jean Charcot handed over the library of his father to the administration of the Assistance Publique. The library, which was slowly collected by Professor Charcot, and contains works in all languages on diseases of the nervous system, is now permanently housed in the Salpêtrière Hospital, in the actual bookshelves and surrounded by all the consulting-room furniture and ornaments amidst which Charcot lived and worked. In addition to the minister and Dr. Jean Charcot there were present on the platform M. Mesureur, the director of the Assistance Publique; Professor Raymond, Charcot's successor in the clinical chair of diseases of the nervous system; Professors Bouchard, Marie, Brissaud, Déjerine, Segond, Madame Jean Charcot, Madame Jeanne Charcot, Madame Raymond, and many old pupils and friends of Charcot. Dr. Jean Charcot, in making the gift, said that it was not without a pang that he separated himself from these souvenirs, among which he had grown up, and which he had seen his father collecting and adding to, searching among the bookstalls on the quays, where he was well known, but he thought his father would have approved his action, seeing that he himself had sought other outlets for his energies. Professor Raymond thanked Dr. Jean Charcot for his gift, which, when it was originally offered to the faculty of medicine to be placed in the Salpêtrière, had been refused owing to lack of funds. The money, however, was offered by the Assistance Publique, and the library would always be open to workers from France and abroad. On Charcot's death his son refused a large German offer for the valuable library, and proposed that it should form part of the clinic which his father founded and made famous. M. Mesureur also thanked Dr. Jean Charcot for his act of filial piety. The Assistance Publique was glad to be associated with the state in the matter of teaching, for with its numerous hospitals and organizations for the relief of the poor, it really formed a large school of medicine. M. Mesureur expressed hope that the state would give further help to different clinics which were in want of funds, and thus increase the renown of

medical teaching in France. The minister added a few words of thanks to Dr. Jean Charcot for his abnegation in the higher interests of science and of the university, and hoped that his example would be followed in others. After the distribution of medals to some of the nurses and the gardener of the Salpêtrière, the library was visited by all present.

A COMMITTEE appointed to advise the senate of London University on the course to be pursued in regard to the proposed Institute of Medical Sciences has reported as follows: (*a*) That, owing to the lack of adequate financial support, the scheme for the establishment of an Institute of Medical Sciences, as set forth in the original appeal, and (in a modified form) in the appeal of June, 1905, has proved abortive; (*b*) that, apart from the money difficulty, which, in the opinion of the committee, is of itself fatal, the scheme has also become impracticable for other reasons. The medical faculty, which formerly reported in favor of the scheme, has now reported against it. Several of the medical schools have changed their opinions in the same sense, and some of them have made arrangements involving considerable outlay for providing more efficient instruction in preliminary and intermediate medical studies; (*c*) that, in the above circumstances, the university has no claim to the money which has been already paid by subscribers, or to the fulfilment of promises by subscribers who have not yet paid their subscriptions; and (*d*) that, in the absence of any special directions in any particular case all subscriptions already paid ought at once to be returned to the donors (including in that term the executors or legal representatives of deceased donors) without any suggestion as to any possible application of the money to any other purpose.

UNIVERSITY AND EDUCATIONAL NEWS

THE main building of Monmouth College, including the science laboratories, was destroyed by fire on Thursday morning, November 14. All the science work has suffered much. The loss to the biology department was the greatest, as the laboratory was on the third floor under the roof, where the fire started. The collections and apparatus of that department, which were of much value—and the laboratory—were almost completely destroyed. Plans are being made for rebuilding and carrying on the work meanwhile.

RICE HALL, housing the biological and chemical departments of Washburn college, Topeka, Kansas, was partially destroyed by fire on December 6. The loss, estimated at $30,000, is covered by insurance; the building will be restored in the spring.

PENNSYLVANIA Day at the State College was celebrated on November 22, when the new agricultural building was dedicated. Addresses were made by Governor Edwin S. Stuart, Senator Bois Penrose, Mr. James A. Beaver, president of the Board of Trustees, Dr. Nathan C. Schaeffer, superintendent of public instruction, Director Thomas F. Hunt, of the School of Agriculture, and Director Whitman Jordan, director of the New York State Agricultural Experiment Station, Geneva, N. Y.

ACCORDING to the New York *Evening Post* foreign countries are represented at Harvard University as follows: Canada, 42; China, 24; Japan, 8; England, 5; Mexico, 4; Republic of Argentina, 4; Germany, 3; Italy, 3; Australia, 2; Costa Rica, 2; France, 2; Ireland, 2; New Zealand, 2; Russia, 2; Bulgaria, 2; India, 2; Asia Minor, 1; British West Indies, 1; Korea, 1; Peru, 1; Siam, 1; Colombia, 1; Sweden, 1; Turkey, 1; Syria, 1; Rumania, 1; South Africa, 1.

PRESIDENT NORMAN PLASS, of Washburn College, Topeka, Kans., has resigned to go into business, his resignation to take effect at the close of the academic year.

DR. LOUIS COHEN has been appointed assistant professor of mathematics and Dr. Perley G. Nutting, assistant professor of physics at the George Washington University.

MR. E. T. CAMPAGNAC has been elected professor of education at Liverpool University to fill the vacancy caused by the retirement of Professor Woodward.